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FOUNDRY TRADE JOURNAL

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Rubber in Engineering

It is a good few years since we commented on the subject of rubber in connection with the foundry industry. At that time, it was suggested that it was a possible material for use in coremaking. We seem to remember that there was a fairly high fire-hazard. At any rate, the proposed application has died a natural death—yet so did the CO_2 process when it was first mooted.

To ascertain what was being done nowadays, last week we attended a "Rubber in Engineering" conference and the first outstanding fact learnt was that this material is analogous to cast iron, in so much as both possess a very wide range of properties, but are known to the *hoi polloi* under an "umbrella" name. Thus, rubber can be made resistant to certain chemical attack, can be hard or soft and so forth. In the foundry, it finds extensive use as air-hose, and in the electric-wiring systems, but these can be taken for granted. It is in the wider field of the elimination or serious reduction of vibration and noise that it is of current interest. For instance, one foundry discovered that after installing new ducting for ventilation, the vibration was so bad that nearby windows cracked and broke. It was, after some experiment, cured by suitably-placed rubber padding. Information was forthcoming as to the successful elimination of ground vibration when rubber is intelligently applied to hammers and presses, but we found no matter germane to a similar application to jolt-type moulding machines. To-day, some of these are so powerful as adversely to affect the foundation and structure of the moulding shops. However, some results may be available on this application of rubber and if this be so, then an enquiry to the Natural Rubber Development Board, Market Buildings, Mark Lane, London, E.C.3, will no doubt result in information as to the present state of knowledge of the problem.

Like the foundry industry, the rubber industry has its own research association which has facilities and produces results akin to those familiar to our readers; this was clearly brought out by a film bearing the same title as the conference. It showed very clearly all the layman needs to know about this very interesting industry and disclosed just the sort of information helpful to those who can benefit by learning what has been done. The papers presented at the conference were of major interest to engineers. One of these described the installation of vibration-reduction equipment to a 10-ton hammer, working horizontally—probably the hammer having the largest energy in the world—where, as a result, vibration can only just be felt by a person standing alongside it. Normally, such a hammer would create an earthquake, technically speaking, in that the shock would probably be felt two miles away. To damp this shock so effectively is indeed an admirable feat of unspectacular engineering.

Eleventh IBF Golf Meeting

A party of some 50 members and their wives again met at Woodhall Spa for the annual competitions of the Golfing Society of the Institute of British Foundrymen. Once more the weather was delightful, although a strong wind throughout the event tested the skill of the golfers. Many rose to the occasion and produced low scores; the scratch event was won with the lowest score yet returned in this competition. The results of the competition are listed below:—

Saturday morning: Stroke competition for the IBF Handicap and Scratch Cup (38 competitors).

1. L. Mortlock ..	83— 9=74	Winner Handicap Cup.
2. J. Bell	93—19=74	Second, handicap prize.
3. M. H. Hillman ..	77— 2=75	Winner, Scratch Cup and third handicap prize.
4. P. G. Pennington ..	84— 8=76	
5. W. H. Richards ..	93—17=76	
6. W. E. Aske	98—20=78	
7. J. H. Ainsbury ..	94—15=79	
8. E. G. Evans ..	98—19=79	
9. T. Reynolds.. ..	98—19=79	
10. H. Oliver	100—20=80	
11. H. C. Hanson ..	100—20=80	Winner, Veteran Cup.

In addition to holding the Handicap and Scratch Cups for one year, the winners also received a tankard each, kindly presented by Dr. A. B. Everest, immediate past-president of the Institute. The branch Coronation Shield was won by the West Riding of Yorkshire's branch first team:—W. E. Aske 78, H. Oliver 80, R. Turner 82 = 240. The winners also received prizes presented by last year's winners. The winner of the Veteran Cup also receives a tankard presented by Mr. W. E. Aske.

Saturday afternoon: Two-ball foursome and bogey.

1. E. W. Pugh and T. Reynolds..	All square
2. L. Mortlock and H. Richards	2 down
3. J. G. Phillips and F. A. Wilson	3 down
4. W. Embley and H. Oliver	3 down

The winners each received a chromium-plated "Lincoln Imp," kindly presented by the Lincolnshire branch of the Institute.

Sunday morning: Stableford fourballs.

1. E. W. Pugh and H. Richards..	45 points
2. P. G. Pennington and T. A. Oxley	43 points
3. J. H. Ainsbury and L. Mortlock	41 points
4. W. Jones and G. W. Nicholls	40 points
5. J. P. Wilson and C. H. Wilson	40 points

The winners received ½ dozen golf balls each, kindly presented by Mr. T. A. Oxley.

Ladies' Competition—Stableford.

There were 10 contestants in the competition for the Coronation Rose Bowl who returned some good cards under the blustery conditions:—

1. Mrs. E. W. Pugh	28 points
2. Mrs. W. M. Cook	24 points
3. Mrs. W. Jones	24 points
4. Mrs. W. E. Aske	24 points

In addition to holding the Bowl for one year the winner also received a "Lincoln Imp" presented by the Lincolnshire branch. The first three ladies also received golf balls presented by the Society's president, Mr. A. E. Phillips.

Annual General Meeting

The president of the Society, Mr. A. E. Phillips, in his opening remarks expressed the disappointment of members at the absence of the immediate past-president of the Institute, Dr. A. B. Everest, and this year's president, Mr. H. J. V. Williams. Each had expressed his regret in having to forgo the pleasure of a golfing week-end, through duty calls, and wished the meeting every success. Mr. Phillips also expressed his sorrow that other regular Society members had been unable to join the party, but was glad to welcome others who had returned this year after enforced absence. Thanks were extended to the local Golf Club for the excellent facilities made available for the Society's use and it was disappointing to learn that the course was already booked for the Society's usual week-end in 1957. The meeting decided that the committee should explore the possibilities of another venue for next year.

In tending his resignation as president, Mr. Phillips said how proud he had been to have held this office and he would have long and happy memories of his presidential years. He wished to recommend to the meeting that Mr. F. Arnold Wilson, who had done so much to establish this national event, should succeed him as president. This suggestion was acclaimed unanimously and appreciation was expressed of all Mr. Phillips had done. The honorary secretary also resigned from office and the acceptance by Mr. G. W. Nicholls of this post delighted all members: Mr. Nicholls had not missed a meeting since the war years and had been for many years an active committee member. The thanks of the members were expressed to Mr. Pennington, the retiring secretary. It was proposed and carried that the existing committee be re-elected *en bloc.* Mr. Phillips asked Mrs. Phillips to present the prizes and the meeting closed with a vote of thanks for this service, so graciously performed.

Film Review

Bridge Across Space. 16 or 35 mm.; running time 22 min. Produced for the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1, from whom copies are available on loan.

This is a black-and-white film which has been produced by British Films Limited. The story has for its object the stressing of the elimination of space by the telephone, telegraph and radio, with special reference to the part which the magnet has played in making these developments possible. Shots include the 80-ton electric furnace at the works of Samuel Fox & Company, Limited, and a small high-frequency furnace installed in the foundry of James Neill & Son, Limited. It finishes by showing the world's greatest steerable radio telescope now being built in Cheshire. *Inter alia* it transmits echoes to the moon and the planets and will study sun-spots 93 million miles away. Incidentally, the background music ends on a real wail of discordant notes—probably quite appropriate to the subject. It is a very interesting, if not particularly instructive, documentary film, which has been excellently produced.

Standards for Tin and Tin Alloys

The British Standards Institution has appointed a committee to draw up comprehensive specifications for British standards for tin and tin alloys, including ingot tin, white-metal bearing alloys, tin-base die-casting alloys and soft solders. At the first meeting of the committee, which was attended by representatives of the Services, transport, shipping and manufacturing interests, Mr. W. R. Lewis, assistant director of the Tin Research Institute, was elected chairman. The committee will divide into sub-committees to draw up specifications for each of the subjects covered by the terms of reference. At present, there are different specifications for industry and the Services for the metals and alloys covered by the committee's terms of reference, and it has been felt for some time that a single standard should suffice for all users.

THE FIRST Protective Clothing and Safety Equipment Exhibition will take place at the Empire Hall, Olympia, from May 13 to 17, 1957.

Düsseldorf Exhibitions

By A. R. Parkes

The exhibitions which accompanied the International Foundry Congress held in Düsseldorf from September 1 to 9 (and open daily from 9 a.m. to 6 p.m., Sundays included) were spread over six main halls of the special "NOWEA" exhibition site, on the banks of the Rhine. In one of the buildings within the same area, the technical sessions of the Congress also were held, so that easy passage could be made from one to the other. Hall "P," which housed mainly the castings exhibits, has already been referred to in these columns* and the purpose of this present account is to comment on the equipment and supplies exhibits in the remaining halls as well as those of an historic or educational nature.

After viewing the various exhibitions occupying over 450,000 sq. ft. of floor-space which were organized concurrently with the Congress, one might have much excuse for a pro-German bias, at least so far as the quality of display and versatility of foundry plant and equipment was concerned. It is necessary, however, to try to regard the matter with impartiality, to examine where the UK equipment industry can profit from what was shown and where British founders can gain in efficiency from adaptation of methods and plant on view. Standards of apprentice training, safety and welfare in the industry, metallurgical control and instrumentation, all were dealt with in an extremely comprehensive manner at Düsseldorf and served to set-off the exhibitions making the whole a true mirror of the whole foundry industry on an international basis, surely one never before assembled on such a scale.

HALL "A"

Hall "A" was immediately adjacent to the halls where the Congress technical sessions were held and to the Robert Schumann Hall, where the opening and closing ceremonies were performed. It housed a general information centre about the Trade Fair and the Congress; a design section for foundry plant; an historical section wherein development of both the art and science of founding were traced; a display of foundry literature—partly filled by an exhibit arranged by the documentation department of the German Foundrymen's Association (*Verein Deutscher Giessereifachleute*) and the cinema halls where almost continuous showings of technical films were arranged. Art castings of high merit produced through the centuries of foundry practice formed the basis of the historical section, but there were also a number of other founding exhibits ranging from the period when stone moulds were used for spear-heads right up to present-day intricate highly alloyed castings. Another noteworthy exhibit in this section was the striking array of magnified photomicrographs, phase diagrams, etc., which were mounted in labyrinth fashion to show the field covered by the VDG technical and research service.

HALL "M"

It was in Hall "M" that most of the foundry plant was on show (though notable exceptions from the UK exhibitors' point of view were the stands of Foundry Equipment, Limited† (Fig. 1), and Industrial Foundry Materials, Limited, which were located in Hall N). The stand of the British Moulding Machine Company, Limited†, was, however, in Hall "M." In general, the stands of the UK exhibitors (and that includes the stands of firms, like Foundry Services, Limited; Mond Nickel Company, Limited; and Cupodel, Limited (Fig. 2), who were sharing stands along with their German associate firms) were always a centre of attraction and a consensus of opinion reveals that much solid business and countless promising enquiries resulted from their participation. Of course, many of the German plant manufacturers who were showing have UK agents and in several cases these were present in person on the stands—providing a "homelike" welcome for visiting UK foundrymen.

In Hall "A" section, the writer searched for information as to what German foundrymen and plant engineers are doing about noise suppression but all he found were leaflets about the "Phonotherm" system of R. Thienhaus KG, which seem to advocate the use of spring foundations (called Phonolators), and swing rails for lessening the vibration of heavy machines. The firm also claim to have developed noise-abating and -suppression materials but gave no indication of their type, beyond illustrations showing various sorts of cabinets lined with insulating material with which to enclose, or partially enclose, machinery.

By and large, the German foundrymen appeared to have available (and exhibited) good designs and qualities of protective equipment—goggles, spats, gloves, respirators, etc.—but it was clear from the works visits that few of these are actually worn in foundries. Ventilation of grinders, and so on, likewise has received less attention on the Continent and regulations there appear to be much less stringent than in the UK.

Moulding Machines

Browsing round the stands of Hall "M," one could not but be impressed by the attempts on all sides to move towards "automation" in foundry plant, though, obviously, this was usually at the expense of versatility. A good example of automatic operation of single machines was the extremely robust type BQ model shown by the British Moulding Machine Company, Limited, making

* See JOURNAL, September 20.

† The JOURNAL issue of July 12 contained details of these stands.

Düsseldorf Exhibitions

moulds 25 by 21 by 7 in. in from 15 to 60 sec. The automatic operating valve on this machine was of an entirely new type involving neither electronics nor simple electrics nor yet depending on time sequences. Other heavy machines (and an automatic plant) were shown by Alfelder Maschinenfabric Kuenkel, Wagner & Company (UK agents, Ernest Fairbairn, Limited) with new shockless jolt/rollovers, UR 1 and 1.5 without (and model URP 1 and 1.5 with) a squeeze head. The largest of these takes a load of 3,300 lb. Yet another new moulding machine shown was the " Progress " model of Heinrich Wagner built entirely above floor level, a jolt/squeeze/pin-lift model with remote control throughout its operation or with independent vibration and lift; it had a stroke of 8⅛ in. Both these last-named firms included a variety of other plant on their stands. Yet a further newish machine, Swiss made, was a push-button model (MK 2) which made two half-moulds simultaneously, with two jolt/ramming heads, patternplates and stripping mechanisms on a single turnover yolk. This was shown by Maschinenfabrik and Eisengiesserei, Kallnach. Perhaps most impressive of all plant for moulding was an automatic system comprising indexing moulding stations for both cope and drag, coreplacing, assembly and clamping, movement to pouring station, knocking-out and box return. This plant, claimed to have an output of up to 300 box parts per hour, size approx. 2-ft. square by 7-in. deep, was shown (in operation) by Badische Maschinenfabrik AG (UK agents, W. J. Hooker, Limited). A small feature noted on this and other plants was the fixing of small brushes to remove sand continuously from moulding-box faces or anywhere where sand abrasion might occur. Other items on this stand included a large automatic impeller-type rammer served by a large squeeze/turnover machine, push-button controlled vibratory knock-out grids, shot-blast machines, a heavy-duty muller and a core-sand mixer. A new moulding machine here was the ARP.w. model, fully automatic, jolt/squeeze/turnover/draw.

Other Sand Plant

A very wide variety of sand-treatment plant was on view on several stands, amongst which that of Heinrich Herring was noteworthy. Here, there were the plain aerator/thrower machines and many adaptations of them, up to complete treatment plants—the writer's particular interest being focused on sand plant designed to suit small and jobbing foundries. Yet a further range of plant of this nature was shown by Maschinenfabrik Axmann KG and this firm had both large (up to 6½ m. radius) and baby models of impeller rammers, with and without sand elevators built in.

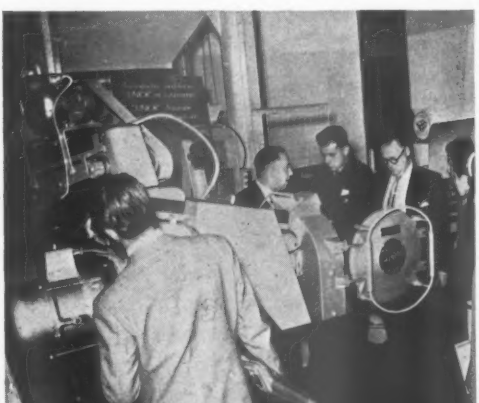
There was no great variety of shell-moulding plant on view in Hall " M," one exception being the stand of the Shallway International Corporation‡ (with headquarters in California). Here, plant on view included the MCM 5 mechanized shell coreblower and the PF-5 pin-type shell fuser, the firm's shell moulding machines being shown on ciné film.

In coremaking machinery, that of Vogel & Schemmann AG (UK agents, Metals & Equipment (Wolverhampton), Limited) was very interesting, a special feature being made of the Coreshooter, model KSA, with CO_2 gassing equipment built in. Other sand-treatment machinery was shown by Peter Hammers of Karlsruhe, including two complete plants, one for 12 to 15 and the other for 5 cub. m. per hour. A very comprehensive range of electromagnetic separators was exhibited by Steinlein & Kunze GmbH, including dross separators for non-ferrous ashes, slags and sweepings.

Cleaning Plant

Shot-blasting and cleaning equipment for castings was well-represented, *inter alia* with plants by Berger Maschinenfabrik and Alfred Gutmann. The former had on view a rotary-table impeller-type cabinet plant, which utilized removable table-tops which could be loaded with castings outside the plant and then hoisted by a four-leg chain sling into the cabinet. Gutmann's had a new large pendulum-type automatic 3-impeller plant for shot-blasting single castings weighing up to 5 or 6 tons and of size up to about 10-ft. square by 13-ft. high. Georg Fischer, whose account of the Buehrer automatic casting plant at Schaffhausen had caused much interest in the technical sessions, also had a heavy push/pull rotary-table Wheelabrator on view, for castings up to 3 tons, in addition to a new model of small monorail-type pendulum Wheelabrator needing no foundations. Blasting aluminium with aluminium " Granal " abrasive was also shown here (Tilghman's are the UK representatives for this). Other machines on view included small models of blast cleaning plant (to suit the needs of small foundries) and a range of sand-testing equipment (UK agents, Foundry Suppliers, Limited).

FIG. 1.—*View of the stand of Foundry Equipment, Limited, in Hall " N " of the Düsseldorf exhibition.*



‡ It is learned that Coleman Wallwork, Limited, are taking the exclusive UK agency for this firm.

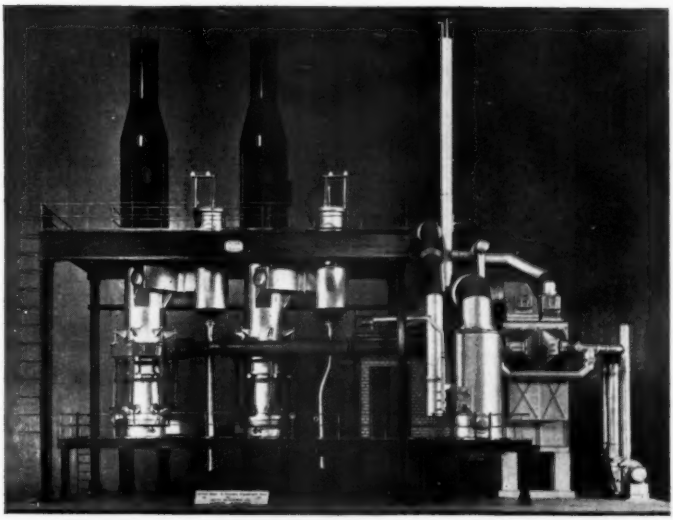


FIG. 2.—*Composite model of the hot-blast cupola installations installed at the foundries of the Textile Machinery Makers' group. It was exhibited by Cupodel, Limited, at the Düsseldorf foundry exhibition last month, and is currently on show at the Fuel Efficiency Exhibition, Olympia, London, on the stand (G.8) of Keith Blackman, Limited.*

An interesting item of plant on the stand of Graue GmbH was an "inching" type of hopper and feed belt for regulating the addition of coal-dust or bentonite in a sand-treatment plant. A novel sand conveyor/elevating belt was shown on one stand. It consisted of triangular angle-pieces bolted to the belt which, when the belt was bent into a trough shape, closed together for lifting the sand; the capacity was 15 to 20 cub. m. per hour and the maximum angle of slope 60 deg.; at the base of the elevator could be arranged a centrifugal thrower to start the sand on its upward movement.

HALL "N"

In aggregate, Hall "N" of the Düsseldorf exhibitions was probably the largest but as it was subdivided into four, its real size was not apparent. In it were melting and heat-treatment furnaces, ladles, drying equipment, pattern equipment and dies, die-casting plant, conveyors, small tools and moulding boxes, foundry supplies and a special recruitment and vocational training section. Such was the size and comprehensiveness of the section, it is impossible in this account to do more than indicate features which "caught the eye."

Amongst the well-documented and tastefully arranged stands was that of Cupodel, Limited, and their German associates, Strico GmbH, who were exhibiting hot-blast equipment and appurtenances thereto. A feature was made of models of the firm's hot-blast installation at the works of Dobson & Barlow, Limited, and Platts (Barton), Limited, both firms being part of the Textile Machinery Makers, Limited, group (see Fig. 2). For their recuperator tubes, Cupodel are employing a novel duplex construction of a steel sealing-end cast-on to grey-iron finned tube. Also exhibited here was the Feldscher gas-washing plant. Notable on the stand of Adolf Claus was a new model of a small shake-out with an electric vibrator and a sand chute, which required no foundations; the company also make large knock-out installations, with underground collection and conveying of sand.

In many examples of continental-made plant dust exhausting was not catered for to anything like the same extent as in this country and this remark applies particularly to portable tools and grinding machines of which many varieties were on view. Only on the stand-grinders of Aug.Joos were perforated work-rests and a toothed-section next to the wheel observed, with an extraction outlet below, but even here the wheel was incompletely enclosed. A good feature of some large German-made double-ended grinders, however, was the wide spacing of the wheels—as much as 6 ft. or more apart on some models. Not so often seen in dressing shops in this country but featured by several firms at Dusseldorf were abrasive-belt buffing machines in a wide variety of types and sizes.

Pattern and Miscellaneous Machinery

For pattern production, the writer was impressed by the versatility of small routers and generally by the extremely wide variety of small tools, air and electrically operated, which were placed at the disposal of the industry. A small model (No. 2,500) pattern router by Max. Striffler KG, and the even smaller "Frizi" model of Friedrich Zimmermann were notable in this category (at the moment it is stated there is no exportable capacity for the latter). H. Sartorius Nachf. had on view a complete range of engineers' tools including large and small bandsaws, lathes, drills, grinders, thicknessing machines and flexible-shaft units. Amongst the display of pattern and die production, that of Müller OHG was specially remarked. Non-destructive testing apparatus was typified on the stand of C. H. F. Müller (U.K. agents Philips Electrical, Limited), who showed a range of self-contained X-ray sets, the Macrotank "D" model seeming to be particularly versatile; fluoroscopy was also featured here, an image-intensifier it was claimed extending the range of a 150 kv. set to an inch or more thickness of steel. Also notable

Düsseldorf Exhibitions

amongst miscellaneous plant was a robust-looking horizontal centrifugal casting machine for non-ferrous metals by "Meguma" Kurt Schiefer. A feature of this plant is that it can be supplied with a drive which is speeded-up automatically as the mould fills, thus equalizing the centrifugal force despite decrease in diameter. For repairing cupola linings and similar applications, the Torkret GmbH patching gun was shown. Two men are needed to operate this equipment, which, it is claimed, saves up to 60 per cent. on labour and 40 per cent. on materials compared with hand application. Two of the models of the machine for applying 1.5 or 2.5 tons per hour are available.

Furnaces and Ladles

Melting furnaces and accessories to the melting operation were concentrated in this section of the exhibition. Here, induction furnaces both of high and low frequency by Otto Junker GmbH were well displayed and some were operating; a range of holding furnaces also was included. Another large display of electric furnaces of many types was staged by the Russ concern, again, low-frequency installations of various sizes and for many metals were typified. Furnaces for melting (tilting, crucible and rotary), core-drying (tower-type, continuous) and heat-treatment (muffle, rotary and box-type) were exhibited by Dr. Schmitz & Apelt. The SKB pressure ladle for magnesium treatment of iron was shown by C. Senssenbrenner and this firm also had on view a number of other ladle designs—new oil-bath gearing has been applied to ladles of from 2½ to 5 tons capacity, and 30 per cent. reduced effort in operation is claimed. An injection lance for the magnesium-powder treatment of iron was shown by the Austrian firm of S. A. Tiroler Röhren—und Metallwerk; it is claimed this process is substantially cheaper for producing spheroidal-graphite than when Ni/Mg or Fe/Si/Mg are used. This firm also had on view a novel CO_2 gassing/vibration/stripping machine for operating in conjunction with a coreblower. It was automatic in operation and could strip vertically or horizontally, vents being arranged through the base table. Yet a further notable item on this stand was an unusual but interesting design of double-caster conveyor pallets. A number of models of gas- and oil-fired bath-type melting furnaces was also shown by Westofen GmbH, including an unusual "Ellipsoid" inclined rotary model in addition to central- and lip-axis tilting units (the latter a new item), and a fixed crucible-type unit.

Sand Mixing and Coremaking

The displays of sand-mixing and coremaking plant in Hall "N" supplemented that in Hall "M." One novel design of machine for sand mixing known as the Zyklos made by Metallbau KG, was shown by small and large models. It consisted of a revolving pan containing the sand into which mixing ploughs and mullers were lowered (running at different speeds) when mixing commences. After treatment of the sand, the muller, etc., was raised and the whole pan turned over to discharge into a container for despatch of the sand to the moulding station; alternatively, with the small unit, the mixing pan itself with its load can be wheeled away. Typical of other stands in its versatile coverage for foundry bonding agents was the stand of Kernfest KG. Here were shown by practical demonstrations the results to be expected from the range of conventional and self-hardening corebinders, the latter being covered by the trade name Kerfix. Other rapid-drying binders, based on swelling meal; a CO_2 bond (Kernex) and a number of oils and starch derivatives were amongst the exhibits. Core ovens of several types and sizes were among the products shown by Braun-Angott, all of which could be supplied with electric heating; low-pressure circulation was featured in most of the models. "Sand-master" equipment for automatically drying, sieving, cooling, storing, measuring and filling sand into a mill was also included here.

UK Firms

Firms from the UK who were exhibiting in Hall "N" all pronounced that their showing was well worth while. One of these, Foundry Equipment, Limited, claimed to have sold all the machines on the stand. Another, Industrial Foundry Materials, Limited, reported that enquiries from almost every country in the world (including Greenland) had been dealt with at the rate of 50 to 60 per day. This firm were showing their small but versatile "Steloy" shell coreblower, which can be arranged singly or built up into multiple units. Cores are blown vertically upwards into a hot box and there is automatic evacuation downwards of all but the adhering sand shell, after a time interval. On a typical installation consisting of three blowing heads, it is claimed that two girl-operators could produce shell cores at the rate of 300 per hour. One other item on this firm's stand was a new type of chaplet consisting of a $\frac{5}{16}$-in. dia. stem spot-welded to a 2-in. sq., flat or curved strip—said to be much less prone to "blowing" than riveted types.

The joint stand of Foundry Services, Limited, and their German associates—Wachenfeld & Company and Hugo Wachenfeld—was well patronized by visitors throughout the exhibition. A feature was made of the application of exothermic tops to steel-ingot production in addition to the range of metal-treatment and addition compounds, etc., which are among the firm's "foundry" specialities.

(To be continued)

New Mill for Steel, Peech & Tozer

Mr. Andrew Jollie, managing director of the Steel, Peech & Tozer branch of the United Steel Companies, Limited, Rotherham, has reported to the works council on the new Brinsworth mill, shortly to be opened. He said that demand was likely to be greater than output for several years to come. Costs were going up faster than steel prices and the way to correct the difference was by increasing efficiency. The raw material position was healthy and the firm had never had so much stock at the works. Foundations for a new scrap bundling press have been completed and the press itself is ready in Germany for delivery.

Receivers, Tapping Systems and Slag Disposal

*Report of Sub-committee T.S.44 of the IBF Technical Council**

(Continued from page 355)

In this part of the Report, receivers, both fixed and portable, heated and non-heated, are considered. Experimental data are recorded as to relative efficiencies and effect on metal composition and structure. Fuels and fuel consumption, refractories and control methods, are also surveyed. The final section, on slag disposal, begins with the provision of containers and continues with descriptions of granulation systems.

II—RECEIVERS

Relation to Continuous Tapping

Continuous tapping without a receiver has very limited application, but is sometimes used in conjunction with a tilting spout from the ends of which a series of ladles may be filled alternately[10]. Another method requires a spout with a capacious, bowl-shaped end which can be tilted backwards while a full ladle is replaced, the cupola metal meanwhile accumulating in the bowl[11]. Without a reservoir of molten metal, a uniform pouring rate is essential, and no appreciable mixing occurs. On the other hand, when a receiver is used, continuous tapping is usual but not essential. Transfer by ladle to a receiver other than an electric furnace is used, but not recommended, owing to the additional temperature-loss from the extra transfer.

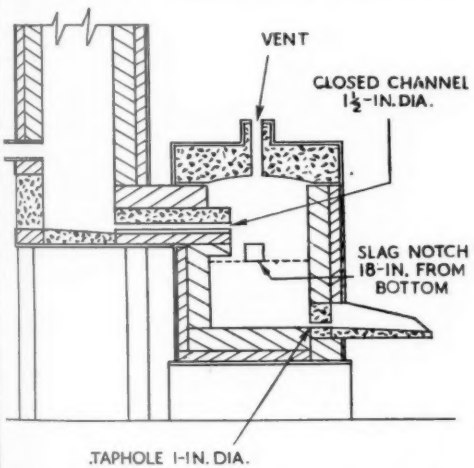


FIG. 10.—*Vertical section of a cupola and forehearth system.*

Receiver Types

Receivers may be: static; semi-mobile or mobile; fixed or tilting; unheated or heated by oil, gas or electricity. In connection with the last, the various types of electric furnaces used as receivers will be considered under the section "electric furnaces as receivers."

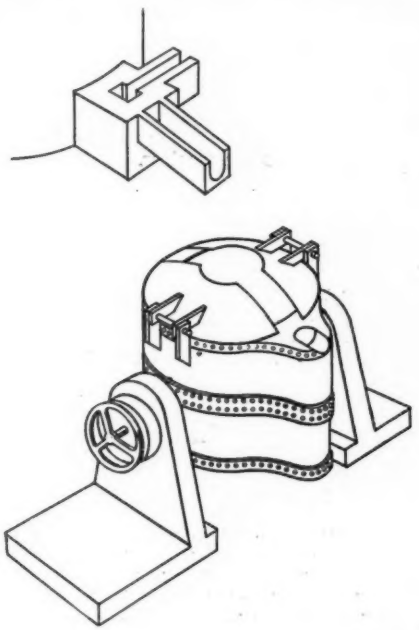


FIG. 11.—*Teapot ladle and Freier-Grunder tapping-box.*

Mobility.

Receivers are sometimes provided with wheels and moved from one cupola to another between shifts. Free rolling is often difficult to maintain

* Submitted for consideration at the annual conference of the Institute of British Foundrymen in Cardiff last June.

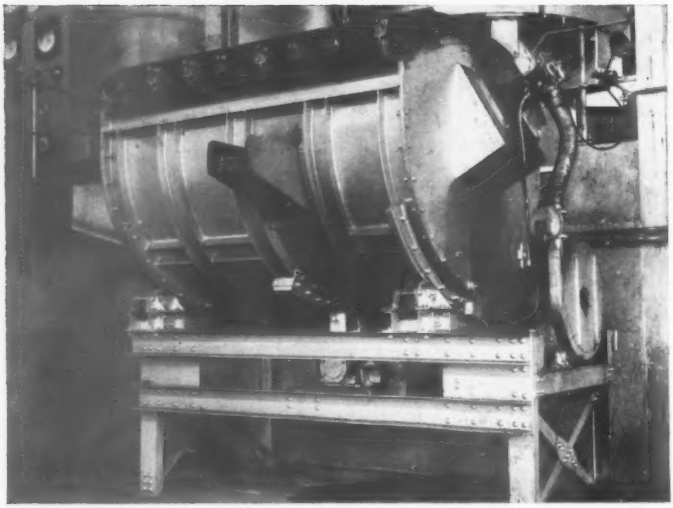


FIG. 12.—*Heated receiver for molten metal.*

owing to metal spillage and sand. Sometimes a receiver is used to transport metal to another part of the shop for pouring, usually by overhead crane. Generally a receiver is erected beside one or two continuous-tapping cupolas, with a chute for metal from each cupola to the receiver.

Fixed Receivers—the Forehearth.

The forehearth is usually a vertical cylinder, comparable with the cupola in cross-section, and either joined directly to the cupola or connected to it by a short spout. The cupola may have a simple taphole and an enclosed spout into a sealed forehearth, a small outlet being provided in the roof (Fig. 10). Metal and slag drain into the forehearth, from which accumulated slag is removed through a slag notch, while metal is tapped intermittently as from a cupola. The tuyeres may be very near to the cupola bottom.[12] Alternatively, the cupola may be slagged by one of the methods described above under "tapping systems," so that clean metal flows in an open chute to the forehearth[13]. An unusual application of an electric furnace used as a fixed receiver is included under the section "electric furnaces as receivers."

In comparison with an intermittently-tapped cupola, the use of a forehearth for metal storage avoids erratic carbon pick-up from prolonged contact between metal and coke and reduces carbon pick-up with charges high in steel, enables metal to be stored for short periods or for large castings, and provides for mixing and consequently reduces fluctuations in composition[14]. The forehearth has also been advocated for desulphurization with soda ash, cupola slag being excluded.

Although preheating is employed[15], a substantial temperature loss may occur, particularly in starting, depending upon throughput, quantity held and insulation. As with any receiver, the additional cost of installation and maintenance must be considered. The modern trend in receiver-design strongly favours the tilting types.

Tilting Receivers—Unheated.

For quantity production, a tilting receiver is usually more convenient than a fixed one, since delays in filling ladles are reduced to a minimum

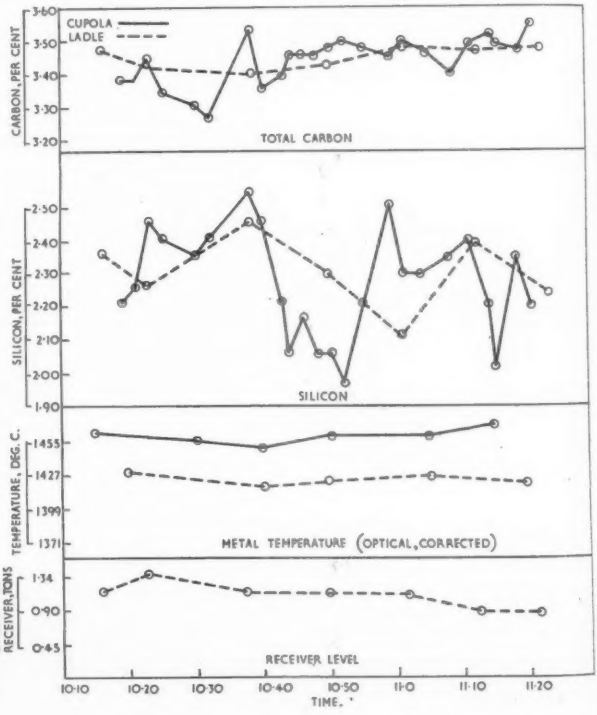


FIG. 13.—*Degree of uniformity of temperature and composition conferred on cupola metal by passing it through an unheated teapot ladle.*

Cupola blast at 370 lb. air per min.; melting rate 5½ tons per hour; ladle-shell temperature 254 deg. C.

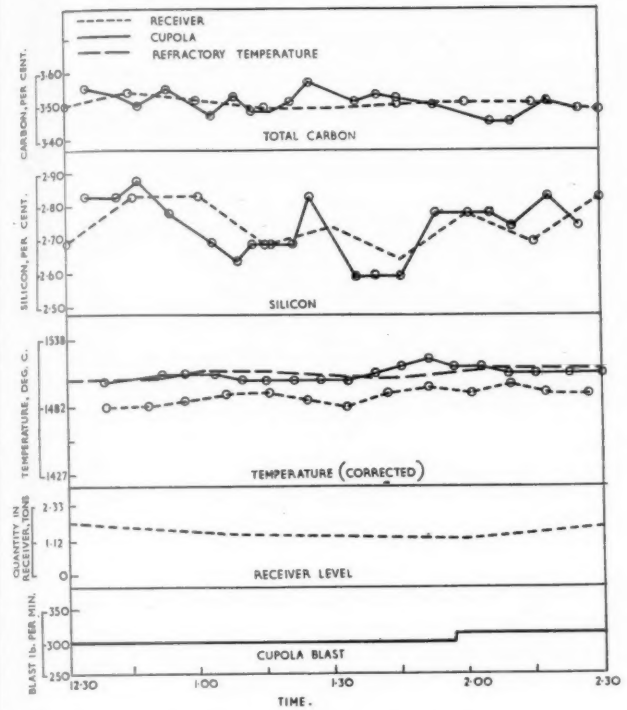


FIG. 14.—*Effect of passing cupola metal through a heated receiver on the temperature and composition of the metal. The graph shows the smoothing effect on composition derived through employment of a heated receiver holding the resulting metal from about* 12*-min. melting, the temperature loss averaging* 18 *deg. C.*

Receiver heating gas consumed at 2,320 cub. ft., and air at 17,600 cub. ft. per hour (air : gas ratio 7.6 : 1); receiver capacity 2½ tons; no slag in receiver before or after run; cupola melting rate 6¾ tons per hour.

by the avoidance of botting and tapping. Unheated types may be ordinary vertical ladles (Fig. 11) or barrel ladles, preferably with teapot spouts. The vertical shape is preferable for its smaller area of exposed surface of metal and slag, but with axis-tilting, the lip height varies considerably as the ladle is rotated. The barrel shape has a larger area of exposed metal and slag, but the bath being shallower, the lip height varies less. Either shape may have a firebrick or a monolithic lining.

Such receivers are usually dried and preheated by a small burner before metal is admitted, in order to reduce the initial temperature loss. They should be covered, leaving the metal inlet opening as small as is consistent with safety. When sufficient time has elapsed and enough metal passed through for the lining temperature to reach equilibrium, the loss diminishes to a level dependent on design, quantity of metal held and rate of flow. For example (Fig. 13), a teapot ladle of 1.3 tons capacity (with a 4½-in. firebrick lining) contained 1.1 tons of metal, while 5.5 tons per hour were passing through, and gave a temperature loss of 33 deg. C. In this case, the storage capacity was equivalent to 15-minutes' melting; capacities equivalent to 10-15 minutes' melting are usual, since larger quantities involve larger temperature losses. The record was obtained from an experimental basic-lined cupola supplying metal of widely-varying composition to the teapot ladle. In passing through the ladle, the fluctuation in carbon content was largely levelled, but the very variable silicon content was inadequately smoothed by the quantity of metal held.

The unfired tilting receiver provides the least-expensive method of exploiting the advantages of continuous tapping, and allows for storage of hot metal and metal mixing (Fig. 13) and also permits small additions of alloys or desulphurizing[16] if required. Refractory maintenance cost for the teapot ladle mentioned, using a graphite and plumbago ramming mixture for the teapot spout, is about 6d. per ton for 120 tons per shift.

Heated Receivers

Application.

Heated receivers have certain advantages over the unfired types, but are considerably more expensive to instal, maintain and operate; for high annual tonnages, the cost per ton is greatly reduced. Where high and steady metal temperatures,

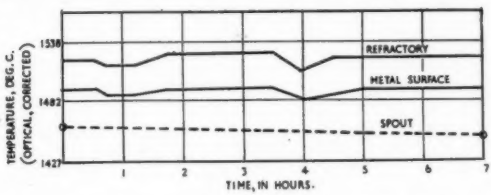


FIG. 15.—*Effect on metal temperature and composition of holding molten metal for period of seven hours in a heated receiver of* 2½ *tons capacity. In this case a loss of only* 11 *deg. C. occurred while holding metal for the seven hours, but the excess combustion air led to a loss of* 0.53 *per cent. total carbon.*

Receiver up to temperature 2½ hours before start of test; air : gas ratio 7.4 : 1 (note excess air); metal in receiver 1.5 tons; surface of metal clean at start, small quantity of slag covering metal surface at end of test; bath not rabbled during test; temperature drop over the holding period 11 deg. C.; effect on composition: Si, no change; T.C., 3.32 per cent. to commence, 2.95 per cent. after three hours and 2.79 per cent. after seven hours.

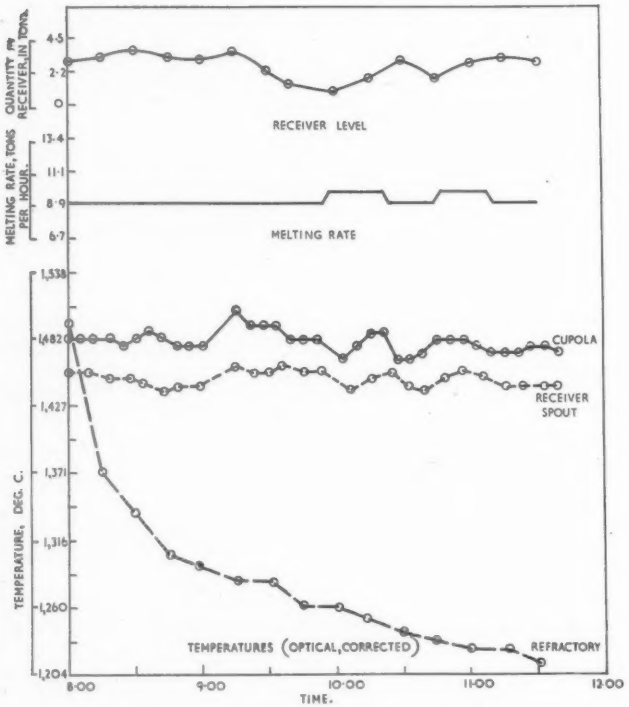


FIG. 16.—*Operational record for 3½-ton capacity receiver, with the heating temporarily discontinued. In this test, the fuel was cut off the receiver for 3½ hours, while melting continued, and no noticeable loss in metal temperature resulted, though the refractory temperature fell from 1,500 to 1,220 deg. C.*

Receiver clear of slag during run; heating gas turned off at 8.0 a.m.; average temperature loss 32.6 deg. C.

uniformity of composition and a large reservoir of metal to maintain continuity of metal supply are all important, and where the total tonnage is high for the cupola size, then a heated receiver becomes a justifiable expense.

Design.

The heated receiver (Fig. 12) is usually U-shaped in section and longer than unheated types. To facilitate heat-transfer from the flame and roof to the bath, a large surface-area and a shallow bath are required. While the bath is absorbing heat from the flame and by radiation from the roof, it is losing heat by conduction through the refractories in the bottom and sides. Further, there are indications of "layering" in a standing bath, the hot metal in contact with the flame being lower in density than the cooler metal in contact with the refractories, so that little convection occurs in the bath. These considerations favour a shallow bath.

Metal may flow in from the cupola spout through a slot in the receiver roof, provided the spout height is sufficient. From a lower cupola spout, metal may flow into a heavily-lined hopper located at the end of the receiver away from the burner, and at axis level to avoid excessive movement when the receiver is tilted. While it is possible to attach a hopper to the back of the receiver, the vertical distance moved by the hopper when the receiver is tilted would be excessive, so that the cupola spout would be high, and splashing and temperature loss would be greater except with the receiver tilted forward. To avoid unnecessary temperature-loss and refractory erosion, the cupola spout should not be higher than is necessary for adequate clearance. A door is provided at the back for periodical removal of slag formed by refractory erosion. The metal spout contains a slag-trap to prevent slag escaping until the receiver is almost empty. The smaller receivers are usually manually tilted by a handwheel, gearbox, rack and pinion. Larger receivers are often tilted by an electric motor.

A completely different type of gas-fired receiver of 10 tons capacity has been designed for prolonged storage of metal, using 24 in. of refractory and insulation and a deep bath, with high-velocity tunnel burners.[17]

Capacity.

The main functions of a receiver are to provide a reservoir of metal and to smooth fluctuations in composition and temperature. The maximum receiver capacity may be decided according to the storage capacity required in the particular foundry considered. With correct charging and operation, fluctuations in composition and temperature will not normally be deciding factors, but if uniformity of composition is exceptionally important or the charge contains high proportions of steel scrap or ferro-alloys, a large receiver may be required. The capacity is usually equivalent to 15 to 30 minutes' melting, but may be more in exceptional cases. It is shown later that there is usually some loss in temperature when metal is held in a receiver, even in a heated one, and hence a receiver could be too large for its purpose.

Refractories.

Heated receivers are usually bricked with silica throughout, though monolithic walls are found satisfactory in some foundries. Used or scrapped silica bricks, crushed and milled to maximum packing-density, form an excellent and cheap bottom when rammed dry and without bond; a thin steel sheet, say 20 gauge, may be laid on the

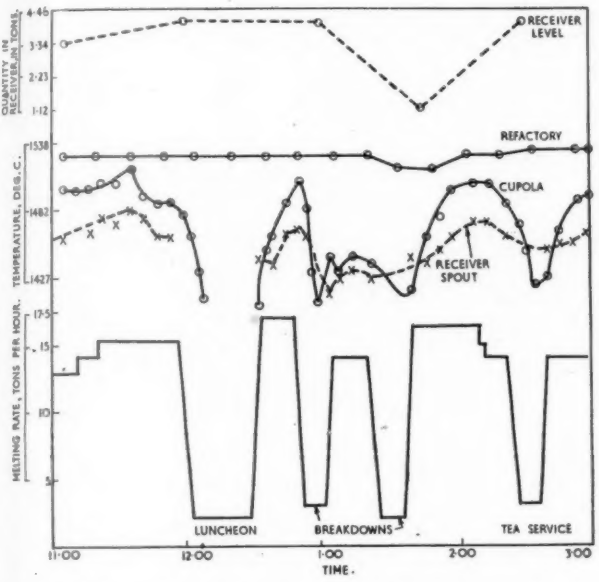


FIG. 17.—*Record showing reduction in cupola-metal temperature-fluctuation resulting from the employment of a heated receiver of 5 tons capacity. It shows the partial smoothing effect of the receiver when melting was repeatedly interrupted and fluctuating melting temperatures ensued.*

Test commenced at the 13th hour of cupola operation; a heating-gas setting of 2,560 and air of 15,200 cub. ft. per hour; temperature readings by optical pyrometer (corrected).

brick dust to prevent any disturbance before metal is admitted. A minimum lining thickness of 9 in. plus 4½-in. insulation is desirable.

To prolong wall and roof life, the refractory temperature may be controlled below 1,550 deg. C. (measuring the temperature of the refractory by uncorrected readings with an optical pyrometer, viewing through the flame).

Metal Temperature

It must be clearly understood that receivers of the type under consideration are not intended to raise the temperature of the metal they contain. Normally, hot metal will lose temperature in a heated receiver (Figs. 14 and 15), though a small quantity in a clean receiver may be slowly heated, and cold metal may be slowly heated to 1,400 or 1,450 deg. C. (Fig. 19). Clearly, if the receiver is operated at a higher refractory temperature than 1,550 deg. C., the equilibrium metal temperature will also be raised, unless rapid slag-formation at the higher temperature interferes with heat-transfer to the metal surface. If its surface is reasonably clean, cupola metal at normal temperature may be held indefinitely without a significant loss in temperature, provided the refractories are previously heated to equilibrium and the exposed refractory is maintained at about 1,550 deg. C. (Fig. 15).

With a normal rate of flow of iron through a hot receiver, it is found in practice that no measurable increase in temperature-loss occurs if the fuel is cut off (Fig. 16). The thermal capacity of the quantity of metal passed through in a given period is high in relation to the quantity of heat which the metal can absorb from the receiver.

The use of a 36-cwt. rotary furnace to raise metal temperature from 1,380 to 1,500 deg. C. in 30 min., using 11.2 gall. of oil per ton, has been described.[18]

Fuel Consumption

Firing practice for receivers varies from foundry to foundry, and the following notes are merely for guidance. For the first shift of a newly-lined receiver, the fuel supply may be slowly increased over 10 hours or more to heat the receiver from cold, and to hold it near the maximum temperature for one hour before metal is admitted. Silica linings should be carefully heated between 580 and 800 deg. C. to avoid the characteristic spalling in that range. As soon as the temperature of the metal

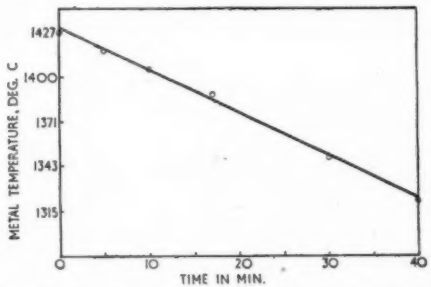


FIG. 18.—*Cooling rate of 1.9 tons of molten metal standing in a receiver of 2¼ tons capacity. Hot metal was left standing in a heated receiver after the flame was extinguished, with a loss of 105 deg. C. in 40 min. With a layer of slag the loss would be reduced.*

Receiver previously in use for 4 hours; temperature of refractory at time of adding metal, 1,482 deg. C.; no further heating applied; surface of metal clean; cooling rate 2.64 deg. C. per min.; all temperature readings taken by immersion-type pyrometer in the bath.

from the receiver is sufficient, the fuel and air should be turned off, until about 20 min. before each anticipated melting stop of more than a few minutes' duration; firing should then be maintained

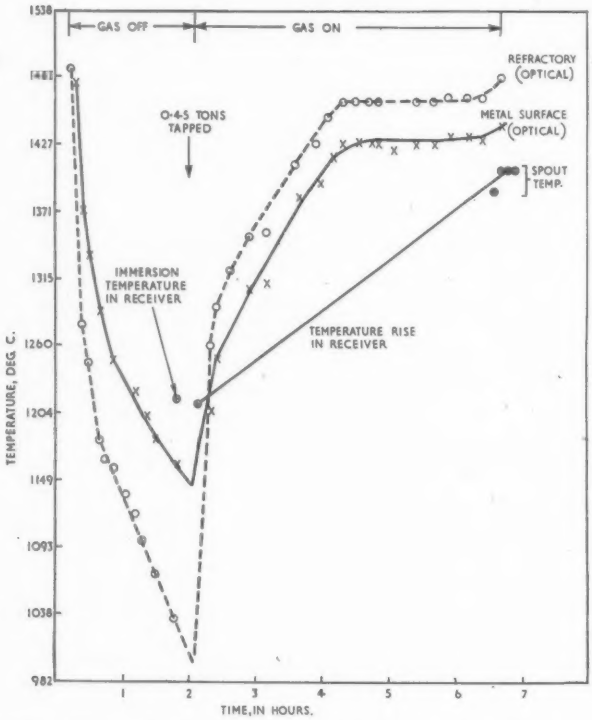


FIG. 19.—*Cooling and heating molten metal in a gas-fired receiver of 2¼ tons capacity. In this experiment, a hot receiver of metal was allowed to cool from 1,480 deg. C. for two hours to 1,000 deg. C.; during this time (optical) temperatures taken on the bath surface fell from 1,480 deg. C. to 1,150 deg. C. At that juncture, an immersion reading in the bath showed a temperature of 1,200 deg. C. and a ladle was tapped at 1,200 deg. C. Fuel was then re-ignited and over 2½ hours the refractory temperature-reading rose by 460 deg. C. and the optical-temperature reading on the metal surface by 285 deg. C. to 1,435 deg. C. and then remained stationary for 2 hours. The receiver was emptied and the metal tapped at 1,400 deg. C. The final spout temperatures were 80 deg. C. below the refractory temperature and correspondingly higher metal temperatures would be expected from higher refractory temperatures.*

Receiver lighted 11 hours and at temperature ½ hour before test; metal in the receiver 2 tons during cooling and 1.55 tons during heating; surface of metal clean; bath rabbled before each temperature reading; cooling rate 146 deg. C. per hour; heating rate 43 deg. C. per hour.

until melting and pouring have restarted, and metal temperatures are normal. About 20 min. before production ceases, the fuel should be used again, so that any residual slag may be drained from the receiver after the last metal. A gas torch may be left in the receiver between shifts, and for the second day the warm receiver may be lit two hours before metal is admitted. It is preferable to maintain the temperature of silica linings at over 200 deg. C. between shifts.

When a breakdown or other unexpected stoppage occurs, fuel should be lit immediately. Usually some margin exists over minimum-temperature requirements, and the loss whilst the receiver is reheated is not disastrous. However, in difficult circumstances while metal temperature is barely adequate for the moulds to be poured, it may be considered advisable to fire the receiver until the metal temperature improves, against the possibility of a breakdown leading to a prolonged delay for "cold" iron. On the other hand, if metal temperatures are higher than necessary, the periods of use of fuel may be reduced below those suggested here. For double-shift operation, less preheating is required before metal is admitted, more advantage being gained by the residual heat from a previous melt.

In a typical, single-shift operation, fuel is used for 6½ hours during melting, but this time may be substantially reduced if there is a good margin of metal-temperature over minimum requirements, or if melting stops are few and short. The following hourly consumption figures were taken for receivers of capacities quoted:—1.3 tons—2,500 cub. ft. per hr. of gas at 520 BTU per cub. ft.; 4.5 tons—3,500 cub. ft. per hr. of gas at 520 BTU per cub. ft. For the latter size an oil consumption of 12 gall. per hr. has also been given.[19]

Other Factors

Refractory and Fuel Costs.

For one oil-fired receiver of 2¼ tons capacity, passing 5 tons per hour, and operating one shift per day, the total annual refractory cost for labour and material was £460 for an annual throughput of 10,000 tons, which is equivalent to 11d. per ton. Fuel was used continuously but reduced for high hourly-tonnages and averaged 2¼ galls., costing 2s. per ton. For a 5-ton gas-fired receiver passing 18 tons per hour and operating two shifts per day, the annual refractory cost for labour and material was £1,058 for an annual throughput of 45,000 tons, which is equivalent to about 6d. per ton. At 1s. 3d. per therm, the overall fuel cost was 1s. 4½d. per ton.

Analytical and Temperature Control.

Fluctuations in metal composition and temperature are smoothed to a degree dependent on the quantity stored in comparison with the metal flow-rate (Figs. 13, 17 and 20). It must be remembered

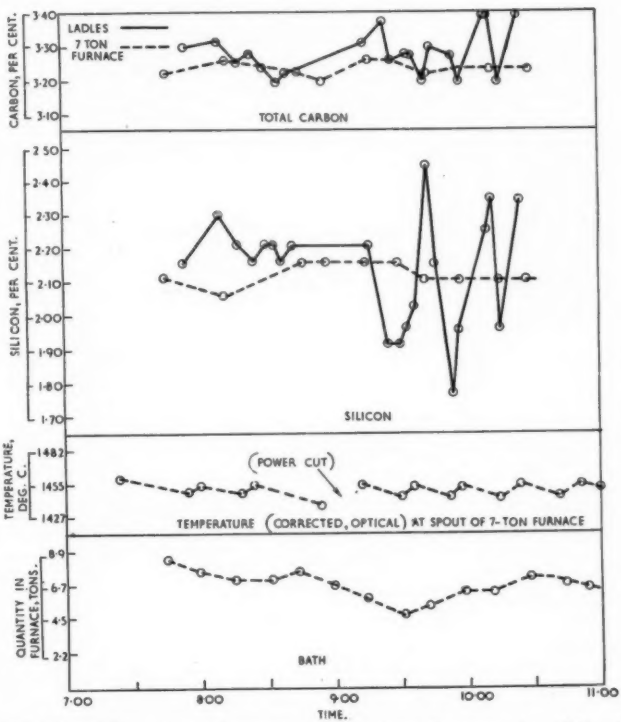


FIG. 20.—*Effect on the composition of molten metal of passing it through a 7-ton electric holding furnace. Here, metal of fluctuating composition from several cupolas running different irons was taken in 0.5-ton ladles to an electric furnace in which about 6 or 7 tons were held while 4 ton per hour were poured; i.e., the weight represented by 1 hr. 40 min. of pouring weight was stored. With this large bath, the extreme variations in analysis were equalized as shown in the record, and metal temperatures were easily held within 10 deg. C.*

that if a certain volume of metal is required for uniformity of composition, that volume cannot simultaneously be available to meet variations in hot-metal supply and demand. In practice, it is usual to compromise and maintain a receiver about two-thirds full on the average, so as to allow for fluctuations in demand or breakdown in supply; during an acute shortage of metal, the receiver may be almost emptied if composition fluctuations of the cupola metal are normal.

When a receiver is used for the storage of metal for prolonged periods, correct proportions of air to fuel should be used; if a large excess of air is maintained, oxidation may occur and particularly loss of carbon (Fig. 15).

In conjunction with the use of rapid fracture-bar tests, ferro-alloys may be added to the metal in the receiver if required, or systematic additions may be made; if surplus temperature is available, controlled and limited quantities of steel scrap may also be added. Carbon as crushed electrode material may be used as an inoculant and for a small carbon pick-up. The use of a receiver for desulphurizing with soda ash, preferably using a basic lining, appears to be of limited efficacy in the absence of vigorous mixing of metal and soda-ash slag.

Modification of Cast Structure

Evidence before the sub-committee indicates that the propensity for chilling at the extreme edges of thin-section castings is slightly increased if the metal is held in a gas-fired receiver; while metal held for an hour or more in a direct-arc furnace shows a deeper chill, corresponding to about 0.15 per cent. lowering of silicon, and the effect becomes more marked by holding for very prolonged periods. In all cases, no detectable difference in composition can be shown; in extreme cases in the electric furnace, inoculation may be necessary to avoid chilled castings. Similarly, malleable iron of a certain composition which is mottled if melted in an air-furnace or a rotary furnace, is white if melted or duplexed in an electric furnace to the same composition. On the other hand, metal transferred to a rocking-arc furnace shows less chill, presumably because of inoculation from spalling electrodes.

Receiver Experiments.

A number of test runs, designed to illustrate certain operating characteristics of receivers, were made under the limitations imposed by production requirements in a mechanized foundry. Examples of the results obtained are shown graphically and annotated in the respective captions to Figs. 14 to 20.

III—ELECTRIC FURNACES AS RECEIVERS

With the receivers considered in the previous section, temperature-limitations prevent solid additions being made except in small quantities according to the excess heat in the cupola metal, but as electric furnaces are primarily melting units, substantial solid additions are possible with these types of receivers according to the power input.

The following types of furnace are available for use as metal receivers and examples of some applications are given in Table II.

(1) *Three-phase, Tilting, Arc-furnace (Heroult-type).*

An example of the well-known type of three-phase arc-furnace is illustrated in Fig. 21, but a

TABLE II.—*Some Electric Furnaces Used as Receivers.*

Type.	Nominal capacity (tons).	Rating. (kva).	Metal.	Solids charged per cent.	Temp. deg. C.		kwh. per ton.	Electrodes lb. per ton.	Tonnage per shift.	Hours of operation per shift.	Method of operation.	Refractories.	Notes.
					Input.	Spout.							
Three-phase Arc	7	(2,500)	Grey iron ..	0.25	1,370	1,410	65	5½*	40	10	Duplexing with 15-cwt. ladles	Silica bricks. Monolithic silica hearth	O.-h.-v. cylinder-heads, etc.
Three-phase Arc	3½	800	Blackheart malleable	13 overall 9 during run	1,390	1,470	210 170	5*	20	9½	18-cwt. cold melt then duplexing with 8-cwt. ladles	Silica-brick roof, life 660T Ganister Lining	—
Three-phase Arc	¾	350	Grey iron ..	12.25	1,300	1,400	238	2*	10	10	8-cwt. cold melt then duplexing	Silica-brick roof, life 8 weeks. Ganister Lining	High-quality iron for centrifugally-cast liners.
Three-phase Arc	¾	500											
Three-phase Arc (static)	1½	200	Whiteheart malleable	0	1,510	1,450 (min.)	—	1	30	—	As a cupola forehearth	Rammed-ganister, life 3 weeks. Sillimanite-brick hearth, life 3½ months. Sillimanite-brick roof, life 6 months	Very light castings. Hand adjustment by two electrodes and automatic control from one. High taphole to maintain bath. Usually consecutive ladles filled without botting (45 lb.)
Rocking resistor	1¼	—	Grey iron ..	—	1,350	1,420	215 overall 120 during run	2	10	15	Predominantly duplexing	Insulated Monolithic, life 350 t.	High-grade iron for centrifugally-cast piston-ring pots and liners. The carbon loss during 4 hours holding is 0.3 per cent.
Normal-frequency, Core-type	¼	120	Grey iron ..	—	1,450	1,490	62 overall	nil	14	—	(Details in text)	Acid, slot life 3 weeks Basic, life 6 weeks	0.45 tons left in overnight with input 35 kw.; first cold metal from cupola excluded. Normal loading 70 kw.

* The higher figures are apparently due to oxidation from ingress of air, through an open side door.

wide range of capacities and electrical inputs is available.[21] Fig. 20 shows graphically some operational data for a larger furnace. Both operating experience and metallurgical supervision are necessary for the efficient operation of these furnaces,[22] to maintain the temperatures desired, to avoid excessive loss or pick-up of carbon or silicon, and to prolong refractory life. A metal loss of the order of 5 per cent. of the output may be expected, and the smoke evolved, particularly at heavy electrical loadings, may require extraction from the working place.

(2) *Three-phase, Static-type Arc-Furnace.*

The application of the static type of arc-furnace is extremely limited, but one installation is known to be in use as a heated forehearth.

(3) *Single-phase, Rocking-arc Furnace (or Indirect-arc Type).*

Rocking-arc furnaces are used in capacities up to 1 ton, and are convenient for additions of alloys for special castings.[23] The single-phase load is usually limited to 300 kva. by supply authorities, unless suitable balancers are employed.

(4) *Single-phase, Rocking-resistor Furnace.*

In another type of rocking electric furnace, heat is radiated from a carbon resistor passing through the horizontal furnace-axis, incidentally avoiding the marked noise associated with the rocking-arc furnace, but retaining the objectionable single-phase load. With two resistors and suitable electrical equipment, a balanced load is obtainable for larger furnaces.[24] Current and electrode con-

FIG. 21.—*Adding molten metal from a ladle to a three-phase, electric-arc furnace.*

sumptions are higher than in the rocking-arc furnace.[24]

(5) *Normal-frequency Channel or Core-type Induction Furnace.*

In an induction furnace, heat is generated in the charge by its resistance to electric current induced in it. Fig. 22 is an outline drawing of a channel-type, mains-frequency furnace, in which electrical input is dependent upon the maintenance of a specified slot-size, which requires the choice of a suitable lining material.[25] The superior basic-lining, mentioned in Table II, is five times as costly as the acid lining. Maximum electrical input is limited by channel erosion, though two channels may be incorporated in the larger furnaces, and one supplier quotes an input of 800 kva. and a lining life of six months as operating data. The installation has an inherently-high power-factor, and initial and operating costs substantially lower than that of a comparable arc furnace.

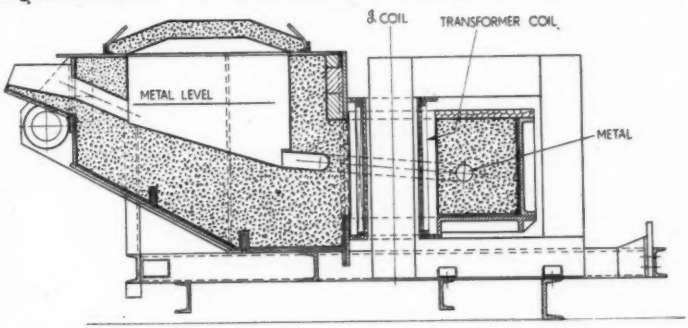


FIG. 22.,—*Sectional sketch of a normal-frequency, cored, electric-induction furnace.*

Example of Operating Details.

The unit listed last in Table II is operated in the following manner: The furnace is tilted by a 5-ton electric hoist connected to the rear. Air cooling is provided on the primary coil. The unit is situated midway between two cupolas, each of which is connected by a launder to the normal-frequency receiver. Overnight, 0.45 tons metal are left in the receiver with power input 35 kw. and at 5 a.m. the input to the electric receiver is increased. At 7 a.m. the first metal is tapped from cupolas, but this does not go into the electric furnace, the connecting spout to the receiver at that time being blocked. When cupola-metal temperature reaches about 1,450 deg. C., it is allowed to run into the receiver, and thereafter the cupola is tapped at intervals of 5 to 6 min.; just prior to each tap 0.22 tons of metal are taken from the receiver. All surplus metal remaining in the casting ladles is returned to the receiver.

(6) *Normal-frequency, Coreless, Induction Furnace.*

In the coreless induction furnace, an example of which is illustrated in Fig. 23, the inductor coil surrounds the bath. An increasing interest is being shown in this type, where it may be used also for melting borings, but the capital cost is higher than that of the channel types, since additional capacitors are required to improve the power factor. Operating costs are similar, and heavier electrical inputs are obtainable, but vigorous stirring of the bath is induced, controllable according to furnace design and power input[26]. Unlike the cored type, the electrical input varies with the bath level, a disadvantage for a hot metal receiver, though frequent adjustments to the load can be made.

(7) *High-frequency Induction Furnace.*

The high-frequency induction furnace resembles the coreless furnace, but requires an expensive convertor unit which renders the furnace uneconomic for use as a receiver, particularly in the smaller sizes.

Further Applications of Electrical Heating.

Two schemes for using the cupola well as an electrically-heated receiver have been described: Piworwarsky proposed converting the well into an induction furnace[27], and electrodes inserted radially into the well are in regular use in one foundry[28].

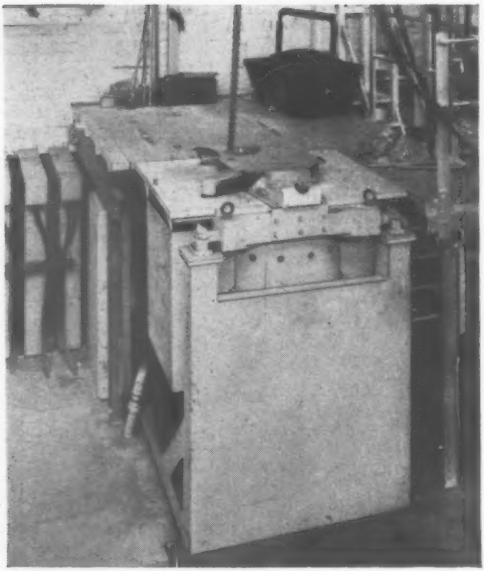


FIG. 23.—*Normal-frequency, core-less, electric-induction furnace.*

General Considerations

The high initial and operating costs of electric furnaces may only be justified where close compositional or temperature control or exceptionally high temperatures are required or where substantial solid additions are made. Conversely, if an electric furnace and a cupola are both required, it may be possible to design and locate the electric furnace to fulfil the additional function of a receiver for the cupola metal. To the extent that solids are added, the unit acts as a melting furnace, with corresponding increases in capital cost, power consumption, refractory erosion and electrode consumption—for furnaces using electrodes. The use of electric furnaces for melting swarf is increasing, but considerations are limited here to their use as receivers, charged mainly with molten metal.

With the temperature control attainable in an electric furnace used as a receiver, the furnace capacity may be as large as required, with due consideration of initial and operating costs; in addition, iron unsuitable for pouring may be returned to the furnace to avoid pigging. Induction furnaces are particularly suitable where close control of composition is required. Mention of the effect of electric furnaces on chilling propensity has been made above under the section on " receivers, modification of cast structure ".

IV—SLAG DISPOSAL

Where cupola slag is allowed to fall upon the foundry floor, it creates difficulty of access, becomes a danger to personnel, and may need breaking before removal. The quantity of slag, foundry layout and water cost should be considered in selecting a suitable system of slag handling[29].

Slag Containers.

Molten slag may be collected in a suitable ladle of heavy section with a generous angle of taper at the sides to facilitate discharge. A thin layer of sand assists in emptying and provides a safeguard against the adhesion of any metal. A loose bottom may be provided to simplify the geometry of the vessel and assist emptying[30]. Trunnions may be provided for handling by crane or a fork-lift truck; a bale and tipping mechanism may be utilized, sometimes on a monorail; or a tipping ladle may be mounted on wheels and also on rails.

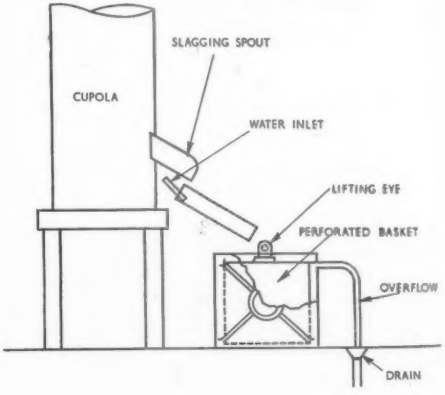
Granulation

Impingement of a stream of molten slag upon sufficient cold water induces granulation. The slag may fall into a short trough of flowing water, directing the mixture into a tank where granulation is completed (Fig. 24), or it may be sluiced along a trough for disposal at a point remote from the cupola (Fig. 25). Metal which finds its way through the slag notch may also be safely granulated. Slag spouts should be refractory-lined and as short and steep as possible. When sluiced in a long trough by a sufficient flow of water, the slag will be granulated in the trough and may be collected in a settling tank. The trough may be semi-circular, rectangular, U-shaped or V-shaped.

Water for Granulating.

Given sufficient storage capacity to avoid overheating, the water may be recirculated after separating the granulated slag, additional water being required to replace losses and possibly to reduce water temperature. Water previously discharged,

FIG. 24.—*Schematic layout of the granulation process for cupola slag where the molten slag falls into a trough of flowing water.*



for example from dust-suppression systems, may be utilized, rendering recirculation unnecessary. The proportions of water used in different foundries vary from 120 up to 2,000 gall. per ton of iron. The employment of a minimum of about 100 gall. per ton has some theoretical support, the larger quantities applying where surplus water is conveniently passed through the granulation system, and where additional water is injected to prevent blockages at changes in the direction of flow.

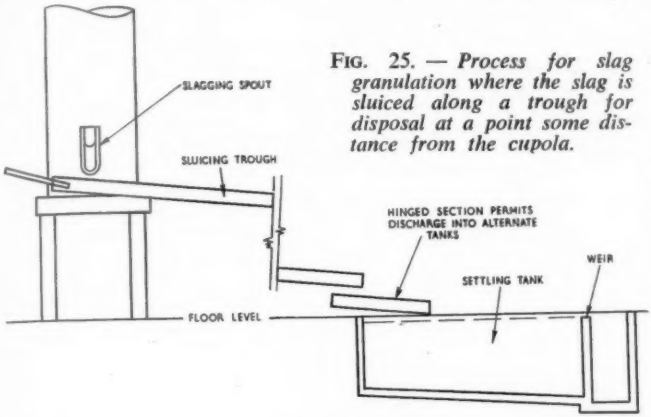


FIG. 25. — *Process for slag granulation where the slag is sluiced along a trough for disposal at a point some distance from the cupola.*

If slag falls directly into a water tank (Fig. 26), granulation ceases when the level of the granulated slag rises to within a foot of the water level, unless the water circulation is sufficiently vigorous to prevent a build-up at the point of slag entry. A heavy flood of water is more effective than a spray in avoiding a build-up in a trough. Make-up water may be introduced at the head of the trough.

Tanks for Granulation or Settling.

For granulation, a steel tank at ground level can be constructed so as to be movable and is sometimes provided with wheels. A water overflow to a drain is required. A settling tank for slag previously granulated in a trough is usually of a permanent nature, and often below ground (Fig. 25). It may be constructed of steel, concrete or brick and this also requires the provision of a water overflow. One tank may be used for a number of cupolas, the granulated slag being sluiced the required distance.

Removal of Granulated Slag.

(1) *Collecting Basket.*—A large basket (Fig. 24) for collecting the granulated slag can be almost immersed in the granulation or settling tank, the top edges projecting above the surface, to retain floating particles. A suitable construction is $\frac{1}{4}$-in. mild-steel plate, perforated with holes of $\frac{1}{2}$-in. to $\frac{3}{4}$-in. dia, for water drainage. The end of the chute may need to be detachable or hinged for withdrawal of the basket.

(2) *Elevator.*—Bucket (Fig. 26) or scraper elevators may be used to remove the slag into a suitable vehicle. A chain drive is preferable to avoid belt slip.

Utilization of Granulated Slag.

Although within many works the slag is used for road grit, cement filler, earth surfacing and similar purposes, there is no instance before the sub-committee of a profitable commercial application.

Acknowledgments

The sub-committee wishes to acknowledge the contribution of bibliographies, diagrams and reports from many sources, including W. & T. Avery, Limited, British Cast Iron Research Association, Birlec, Limited, Blakey's Boot Protectors, Limited, British Piston Ring Company, Limited, Coneygre Foundry, Limited, Constructional Engineering Company, Limited, Dartmouth Auto Castings, Limited, Electric Furnace Company, Limited, Ford Motor Company, Limited, Hepworth & Grandage, Limited, Incandescent Heat Company, Limited, Ley's Malleable Castings Company, Limited, Lloyds (Burton). Limited, Midland Electric Manufacturing Company, Limited, Mond Nickel Company, Limited, Moorwoods, Limited, Platts (Barton), Limited, Qualcast, Limited, Robson Refractories, Limited.

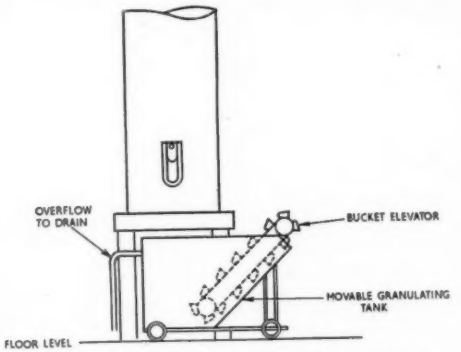


FIG. 26.—*Slag-granulation method employing a moveable tank from which the slag is continuously extracted.*

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APPENDIX

Tapping-box Ramming and Operating Instructions

Preparation of cupola and box

(*a*) The sand bed of the cupola is rammed with moulding sand, with a slope of about 1 in. per foot downwards towards the taphole.

(*b*) The tapping box is rammed around a former with the following mixture (by volume) 50 per cent. ganister with 50 per cent. plumbago (70 per cent. C.), plus 10 per cent. total moisture. The heights of the slag level, A, and the metal level, B (see Fig. 4) which are critical, should be carefully checked before "blowing."

(*c*) The taphole is made as long and strong as possible, but it must not be so long that the tapping bar will not protrude right through. This should be tried out after making-up the hole (the length of the hole may be 6 in. to 8 in. according to the thickness of the lining of the cupola).

(*d*) The taphole at H is 2 in. dia. and is usually sealed by ramming moulding sand in the hole.

(*e*) The bottom of the box is made with a 1¼-in. fall towards the taphole, so that the remaining iron and slag may drain out when the cupola bottom is dropped.

(*f*) One tuyere should be about 2-in. lower than the remainder and about 2-ft. above the taphole; if the tuyeres must be lower, it may be necessary to reduce the metal and slag levels.

Sequence of operations

(1) A gas burner is used to heat the box as much as possible before the beginning of the run.

(2) With a sealed taphole, the cupola is "blown" for about 30 min. before it is tapped with a suitably-shaped bar, or it may be blown until the slag appears at the low tuyere; ultimately the length of blowing time before tapping for a cupola under given conditions of blast, coke-bed height, *etc.*, may be determined by trial to give sufficient metal to flow into the box and over point B. Alternatively, the cupola may be blown with an open taphole.

(3) The iron and slag in the box is covered with either charcoal or fine coke or has a gas flame played on the surface.

(4) About 45 min. after tapping, the slag in the box reaches the slag level and begins to flow over the slag run automatically. The first slag may be tough and require a little assistance. It is, however, very important that as little work as possible is done at the slag overflow, so as to avoid breaking the refractory.

(5) During the run, charcoal, *etc.*, is used on the slag in the box whenever necessary to keep it fluid, for example at low rates of flow or if the blast is off and the flow ceases.

As soon as iron ceases to flow over the metal level, the front hole may be botted and the cupola bottom may be dropped.

Difficulties

Taphole Blowing. If the wind begins to escape through the iron and slag, then the taphole is enlarged or possibly the metal level is too low. Shut off the blast and put a dam of the plumbago mixture on the slag overflow and on the metal outlet, so as to raise the metal level. If necessary, the levels may be raised further, almost to the top of the box.

Slag in Tuyeres. If the slag rises in the well to the level of the tuyeres, then either the taphole or the front hole is partially blocked, or the metal level is too high.

Slag through the Front Hole. Assuming the front hole to be intact and the metal level to be correct, then either the slag level is too high or the slag run is blocked by solidified slag.

Metal over the Slag-spout. The front hole may be obstructed, the metal level may be too high or the slag run too low.

New Factory for Foundry Services, Limited

Last week saw the opening by Foundry Services, Limited, of their new works at Drayton Manor, Tamworth. The "new" works (93,400 sq. ft.) is really a major extension of premises acquired during the war (30,600 sq. ft.), and it has cost something of the order of a quarter of a million pounds to erect. The story of the growth of this business since its establishment some 25 years ago merits the adjective phenomenal. It was started by Mr. Eric Weiss and Dr. K. Strauss to sell fluxes and the like to the foundry industry, always associating sales with service. It now employs some 650 people and is the largest concern of its type in the world. When, during the war, the writer visited the Nechells works, he found huge "pill-making" machines, well-equipped chemical laboratories servicing the foundry industry, and an extensive experimental programme in being for the perfecting of exothermic material for runners and risers.

Since then, the company has grown out of all recognition with associated manufacturing companies in Canada, the United States, South Africa and in four European countries and agencies in 40 other countries. In this country, they claim to have 4,000 customers and 1,000 of these were invited to visit the works during last week.

The Nechells buildings are now turned over completely to research and development. For the "open week" the shops were very intelligently oriented to demonstrate the research activities of the company. The equipment of the laboratories is of the highest order, and really comprehensive, ranging from an installation by British Moulding Machine Company, Limited, to a Gamma-ray set up for the detection of internal flaws. There are two foundries, the older one now being mainly used in the training of representatives and a newer one—particularly well equipped for research and development.

New Factory

The use of aluminium powder for exothermic applications demands that the material must be thoroughly cleaned and thus, before processing, this raw material passes through a degreasing plant where the oil, grease and water are distilled out under vacuum. This plant is adjacent to the department which manufactures "Feedex," the brand of exothermic compounds made by the company. This is located on two floors. As the sleeves have to cater for different types of metal cast in various sorts of moulds, the compounding varies enormously. Thus, conveniently located at the side of this department is the works control laboratory. Powdered aluminium is dangerous as being prone to explosions and thus, an ingenious looking system connects the filling of the mixers on the ground floor with the dispensers on the floor above. Blast-proof doors and walls ensure a maximum of safety to the employees.

The raw-material stores is of considerable size because of the variety of products it has to hold. To guard against the vagaries of delivery, large stocks are maintained. The packing stores is placed at the rear of the raw-material stores, and here there is much work to be done with drums, cartons, bags, etc., and fork-lift trucks and palletizing are extensively used. Situated next to the raw-materials stores is the production section, this being carried out on two floors. From a long battery of hoppers the different preparations are gravity fed to the high-speed mixing machines on the ground floor. Here, efficient dust-extraction plant ensures good working conditions. Heated hoppers ensure freedom from moisture of the material being handled. On the ground floor are a number of Brix presses, a coreshooter for making Feedex sleeves, an automatic packeting machine and the presses for making tabletted products. A special shop is devoted to their manufacture.

Abutting on to this is the finished-products store receiving its goods from the packing departments and passing them on to the despatch department. It is interesting to note that something of the order of 25 per cent. of the production is for export and a special department has been created to operate it. This, and other visits to the foundry supply industry has convinced the writer that they are in no way lagging behind the industry they service in the application of mechanical handling and the general modernity of their undertakings.

Improved Bronze Casting

Experiments which have resulted in the development of an improved method of semi-continuous bronze casting were discussed at the forty-eighth annual meeting of the Institute of Metals in Stuttgart, on September 18. Dr. E. C. Ellwood, chief metallurgist of the Tin Research Institute, Greenford, presented a summary of a paper entitled "Experiments on the Semi-continuous Casting of Bronze" to a joint meeting of the Institute of Metals and the *Deutsche Gesellschaft fur Metallkunde*. The paper was illustrated by a short film.

Experimental work at the Tin Research Institute has brought about the design and building of a relatively simple and inexpensive machine, producing higher quality bronze at a lower cost than that obtained by traditional casting methods. The machine consists of a gas-heated reservoir mounted immediately above a graphite die through which the molten metal passes. After water-cooling the bronze emerges from the bottom of the apparatus as a rod or tube depending on the type of die. The speed at which casting may be carried out varies with the alloy used; the maximum speed attained during these experiments was between 12 and 15 in. per min. Visiting bronze founders from abroad have inspected the machine, the latest version of which produces bronze slabs of a standard suitable for rolling into springs for use in electrical switches and similar appliances.

Birmingham and District Industrial Safety Group

It was announced at a recent meeting of the Birmingham and District Industrial Safety Group that the appeal which was made to their members early in the year for funds to acquire and equip the new Industrial Safety Training Centre at Acocks Green has been closed. The amount required in the first place was £4,000 and the chairman, Mr. C. D. Lovell, works director of Alfred Bird & Sons, Limited, said he was pleased to report that a total amount of £4,579 had been received from subscribers, all members of the Group. (As was recorded in the *Journal* at the time, the Centre was actually opened last April by the Minister of Labour—the Rt. Hon. Iain Macleod M.P.) At the meeting, Mr. C. D. Lovell was presented with a souvenir album of photographs depicting scenes on the day of the official opening, as a token of appreciation of his work in sponsoring the appeal.

Equipment & Supplies

Steel Shot for Blasting

Tilghman's Limited, of Broadheath, Altrincham, Cheshire, in conjunction with their associate company Bradley's (Darlaston), Limited, are now producing cast-steel shot on a commercial basis. Known as Wheelabrator steel shot, this material is produced from electric-furnace steel, which is given a double heat-treatment to produce a tempered-martensite microstructure, resulting in a shot with a unique degree of toughness, solidity, uniformity and operational efficiency. The microstructure of shot is the primary factor in determining such major issues as cleaning speed, shot life, and plant maintenance under subsequent operational conditions.

Factual information based on a variety of tests carried out by Tilghman's, Limited, has shown the steel shot to be superior to chilled-iron shot. The tests were carried out in various types of shot-blast plants on a wide range of workpieces and the observations which resulted are given below:—

Breakdown Rate.—Comparative figures show that the steel shot has an effective life approximately six to eight times that of chilled-iron shot. The average shot consumption over three independent tests was: *Steel shot*—6.7 lb. per wheel hour; *crushed chilled-iron shot*—43.1 lb. per wheel hour, giving an average saving in cost per ton cleaned of 26.3 per cent.

Abrasive Wear on Machine Parts.—The life of protective wearing plates, which came within the effective area of the shot-blast stream, was noted to have increased by 56 per cent. when steel shot was used, over the service period recorded when chilled-iron shot was employed. The life of other machine parts, within the area subject to shot ricochet, was increased by as much as 200 to 300 per cent. when using steel shot. Blade wear was also considerably reduced when steel shot was employed. When using chilled-iron shot, deep grooves were scored in the blade face, but blades used with steel shot showed very little wear after 103 hours' running.

Quality of Work Finish.—The quality of finish obtained from the use of steel shot is more matt in appearance than when using chilled-iron shot, mainly due to the frictional action set up by the steel shot at the point of contact. Iron shot, under similar circumstances, breaks down and shatters.

Rate of Cleaning.—Steel shot is said to have greater striking intensity than crushed chilled-iron shot under identical conditions and actual blast cleaning time can, it is claimed, be reduced by between from 5 and 10 per cent.

Operating Costs.—While the original cost of cast-steel shot is higher than conventional chilled and heat-treated iron abrasives, against this must be set the saving in amount of shot used, reduction in blast cleaning time, lower expenditure on replacement of wearing parts, longer periods of productivity without stoppage for servicing, reduced servicing engineer's time, etc. When all these factors are taken into consideration, a reduction of the order of 15 to 25 per cent. in overall operating costs is claimed. It is thought, the advent of steel shot will assist considerably in meeting the demands of shot-blast users, who for some time have been critical of high maintenance costs of shot-blast machines compared with other foundry equipment.

Liquid Level Switch

A new liquid level switch of advanced design has been developed by Teddington Industrial Equipment, Limited, Sunbury-on-Thames, Middlesex, for the control and indication of liquid level in tanks, boilers, sterilizers and all types of industrial vessels. Operating on an entirely new principle, the switch, designated type WX, has no moving parts yet is capable of switching loads up to 5 amp. at 250 v. a.c. without subsidiary amplifiers or relays, and is particularly suitable for installation where the interior of the vessel being controlled is not readily accessible for cleaning or repairs.

It is a thermal instrument operating on a difference in heat transfer between the sensitive element and the liquid in the vessel, or the sensitive element and the vapour; not on the difference in temperature or latent heat. This principle (protected by UK Patent No. 565,309) gives a very sensitive response, changes of level in the order of $\frac{1}{4}$ in. being sufficient to operate the switch. The operating mechanism is temperature compensated and the instrument is therefore unaffected by temperatures from 0 to 350 deg. F. It also provides an automatic surge damping effect since a positive change in level of sufficient duration to affect the heat-transfer rate is necessary before the switch will operate. This entirely eliminates short-cycling caused by momentary changes in level, which is an important advantage in installations normally subject to surging or vibration. Two models are available offering alternative methods of mounting and production will commence during December.

Mine Diesel Locomotive for Korea

Five narrow-gauge diesel locomotives for use in mines in Korea are being supplied to the United Nations Korean Reconstruction Agency by Ruston & Hornsby, Limited, Lincoln. Three of the units are for underground use and are flameproof models, each powered by a Ruston 48-b.h.p. diesel engine; they have a maximum tractive effort of 3,430 lb. and weigh 7 tons. In Fig. 1, the first locomotive is shown ready for despatch.

The other two locomotives are surface units and are of similar size, but there is no special exhaust equipment, and the maximum tractive effort is 3,780 lb.

FIG. 1.—*The first Ruston narrow-gauge diesel locomotive for Korea, awaiting despatch.*

Dust Control on Grinding Machines

Extended Application of the BSCRA System

Sir George Barnett, H.M. Chief Inspector of Factories, has now approved for universal application the system of dust control for pedestal grinders developed by the British Steel Castings Research Association in conjunction with manufacturers of these machines. This is in addition to his approval of the BSCRA exhaust systems for swing-frame grinders which was granted some months ago.

Originally the Factory Inspectorate's approval of the BSCRA system for pedestal or stand grinders was restricted to their use in steel foundries, but since this created difficulties for the manufacturers, who would thus be required to fit various systems of dust control to machines supplied to various industries, the Association agreed to co-operate with the manufacturers to improve the degree of control provided by their system. The overall approval now granted by Sir George follows the successful conclusion of this further development work.

The improvement has been obtained by increasing the volume of air exhausted through the hood so ventilating the space between the operator's body and the grinding wheel at a higher rate. This increased exhaust volume has been accommodated without requiring a substantial increase in horsepower, by removing the strips which close the gaps between the sides of the wheel and the cowling. This modified hood is shown in Fig. 1 which illustrates the following essential features of the design:—

(1) The underside of the workrest is closed on three sides, only the side nearest the wheel is left open;

(2) the workrest is perforated;

(3) a top flap, which is easily adjustable to wheel wear, is fitted.

(4) The gaps between the sides of the hood and the wheel are left open above the centre-line of the wheel (with a new wheel fitted the size of gaps is 8 by 1 in.), but the gaps below the centre-line are covered.

Exhaust Volume and Dust Control

Observations have shown that an exhaust of 900 cub. ft. per min. per wheel at 2½ in. w.g. provides a satisfactory control of very heavy dust clouds generated not only when grinding iron or steel castings with a thick layer of adhering sand (castings not shot-blasted), but also when grinding refractory bricks. The effect of the exhaust can be judged from the photographs shown in Fig. 2. The photograph on the right (*b*) demonstrates conditions when the exhaust is not operating and the primary dust stream is partially deflected by the workrest, while the secondary dust stream emerges at the top of the hood contaminating the operator's breathing zone. With the exhaust in operation (Fig. 2*a*) the whole of the primary dust stream enters the hood through the perforations in the workrest, and no dust can be seen escaping at the top of the hood.

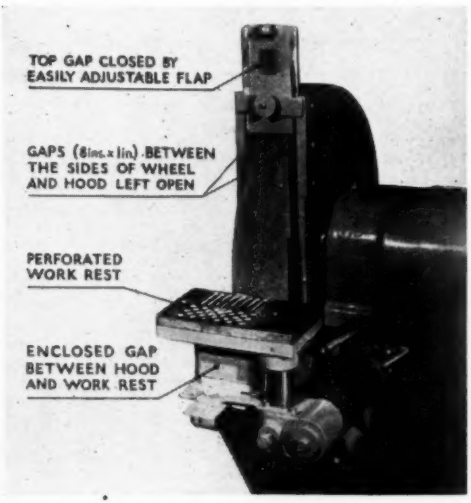
With the aid of smoke generating pellets it has been shown that the exhaust air flows into the hood in the vicinity of the workrest, through the perforations in the workrest and through the slots on both sides of the wheel in the upper part of the hood.

Design of Workrest

These recent trials have confirmed the necessity for a perforated workrest, which the Association recommended several years ago, and which was developed into a roller-type workrest. It will be recalled that the latter type provides the best conditions for the control of dust and has the additional advantage of being self-cleaning. A roller workrest has been employed on production work for many months in one steel foundry and has given satisfactory service.

It is realized, however, that under some conditions of operating the machine, for example, when a push-bar is used, holes must be provided in the workrest to locate the bar. In general, the design of perforations in the workrest will have to be adapted to the conditions of operation, but there

FIG. 1.—*Main features of the BSCRA exhaust hood for pedestal grinders which is now approved for universal application. The grinding wheel is* 24 *in. dia. by* 2½ *in. wide, the peripheral speed* 9,000 *ft. per min. and the exhaust rate* 900 *ft. per min.*


TOP GAP CLOSED BY EASILY ADJUSTABLE FLAP
GAPS (8ins. x 1in) BETWEEN THE SIDES OF WHEEL AND HOOD LEFT OPEN
PERFORATED WORK REST
ENCLOSED GAP BETWEEN HOOD AND WORK REST

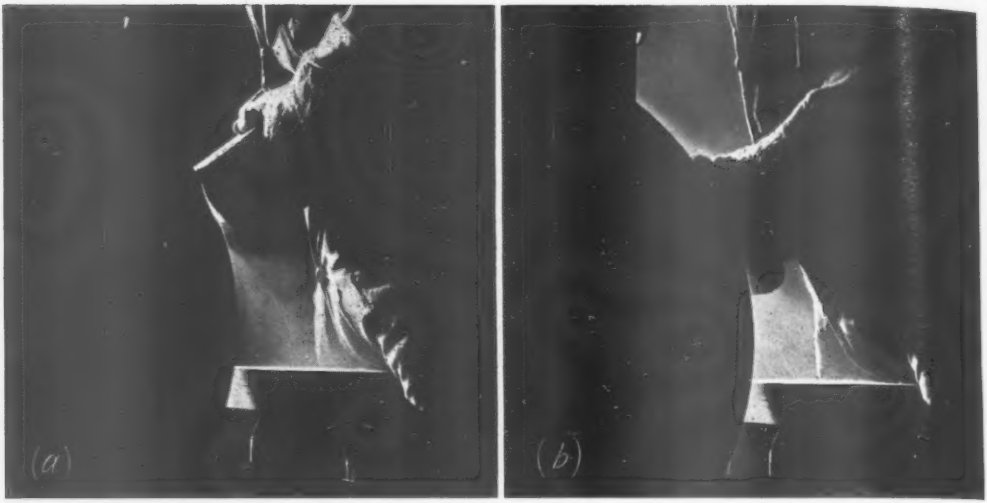


FIG. 2.—*Photographs taken when grinding refractory brick on a machine of the type shown in* FIG. 1: *(a) with the exhaust at 900 cub. ft. per min. in operation and (b) with no exhaust.*

are two important points to be remembered. The first is that an adequate area of perforations must be provided and the perforations must be kept open, and the second point is that the enclosure of the underside of the workrest must extend beyond the area covered by the perforations so that air is exhausted through all the openings in the workrest.

During recent trials the workrest used, which can be seen in Fig. 1, was provided with slots and holes, the arrangement of which is shown in Fig. 3, and the Factory Inspectorate's approval of the system embraces all the usual designs of perforations, provided they are adequately maintained in service. Machines of the approved design are now being manufactured by Luke & Spencer Limited, F. E. Rowland & Company, Limited, and Molineux Foundry Equipment Limited.

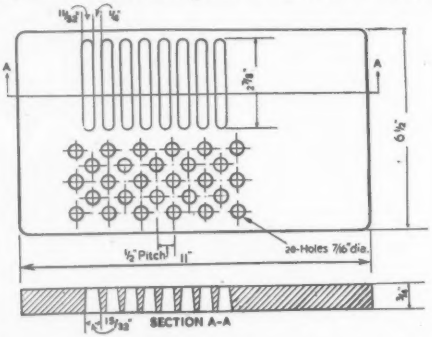


FIG. 3.—*Arrangement of the perforations in the workrest shown in* FIG. 1.

STARTED with the aid of a grant from the Department of Scientific and Industrial Research, a technical advisory service, being conducted by the Birmingham Productivity Association, will put firms who have technical problems in touch with other firms and research organizations prepared to give advice. The service is free at present, but, says Mr. A. B. Waring, chairman of the association, it "might not be so free" if successful.

Contracts Open

*The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.*1 *(telephone: CHAncery* 4411, *ext.* 738 *or* 771), *unless otherwise stated.*

PORTUGUESE WEST AFRICA, October 18—Cast-iron pipes, sluice valves, etc., for the Luanda Light and Water Services. (ESB/19095/56.)

BURMA, October 22—Centrifugal pump, for the Union of Burma Purchase Board, Rangoon. (ESB/24160/56.)

BURMA, October 23—Mobile cranes, for the Union of Burma Purchase Board, Rangoon. (ESB/24201/56.)

INDIA, October 9—Universal testing machine, for the Director-General of Supplies and Disposals, New Delhi (ESB/23801/56.)

INDIA, October 11—Air compressors, for the Director-General of Supplies and Disposals, New Delhi. (ESB/23807/56.)

INDIA, October 16—Universal milling machine, for the Director-General of Supplies and Disposals. (ESB/23766/56.)

INDIA, November 7—Switchgear and accessories, for the Madhya Pradesh Electricity Board, Nagpur. (ESB/23745/56.)

NEW ZEALAND, October 12—Crawler type excavators, for the Stores Manager, Ministry of Works, Wellington. (ESB/24056/56.)

PAKISTAN, October 22—Deep well turbine pump, for the Department of Supply and Development, Government of Pakistan. (ESB/24145/56.)

SOUTHERN RHODESIA, October 25—Vertical spindle surface grinder, for the Rhodesia Railways, Purchasing Board, Bulawayo. (ESB/23751/56.)

Company News

IMPERIAL CHEMICAL INDUSTRIES, LIMITED—Reports that the company is to raise between £30,000,000 and £40,000,000 by an issue of new capital are stated to be without foundation.

NEWMAN, HENDER & COMPANY, LIMITED, iron and non-ferrous founders, etc., of Woodchester (Glos)—Treasury consent has been obtained to issue 254,133 ordinary 1s. shares at 28s. each in the ratio of two for every five ordinary shares held.

GENERAL ELECTRIC COMPANY, LIMITED—The company intends to raise about £14,250,000 net by an offer to capital and loan stockholders of £6,000,000 of 6 per cent. unsecured loan stock, 1976-81, at par and 4,285,320 £1 ordinary shares at £2 per share.

WM. DOXFORD & SONS, LIMITED—The company is raising its final dividend from 12½ to 15 per cent. to make a total of 20 per cent. for the year to June 30; last year's dividend was 17½ per cent. The profit, before taxation, has expanded from £729,285 to £948,140.

CAMMELL LAIRD & COMPANY (SHIPBUILDERS & ENGINEERS), LIMITED—Interim dividend for 1956 is raised to 4 per cent. from 3½ per cent. for 1955. The increase is to round off the figure and does not imply a higher total distribution for the year. Final dividend of 10⅝ per cent. was paid for last year.

ENGLISH ELECTRIC COMPANY, LIMITED—The 4 per cent. 1951-68 debenture stock will not be drawn this year because, in accordance with the terms of the trust deed, the company has made purchases on the market up to the amount set aside for the sinking fund. The outstanding debenture stock amounts to £658,745, taking the outside purchases of £46,732 into consideration.

THE GEORGE COHEN 600 GROUP, LIMITED (formerly George Cohen Sons & Company, Limited)—Application has been made to the council of the London Stock Exchange for permission to deal in and for quotation for the £1,500,000 6 per cent. unsecured loan stock, 1975-80, issued at par by means of a placing. Dealings commenced on Monday on the basis of par to a half premium.

MODERN MACHINE TOOLS, LIMITED—The company's expansion continues; it has acquired the whole of the issued ordinary capital of H. C. Shepherd & Company, Limited, metal furniture manufacturers, of Walton-on-Thames, for £10,000 of its ordinary capital. The company has also entered into a conditional provisional arrangement to acquire the ordinary capital of an engineering business in the Birmingham area. This acquisition would be financed by means of an issue of approximately £106,250 of the company's ordinary capital.

ASSOCIATED ELECTRICAL INDUSTRIES, LIMITED—Group trading profits for the six months to June 30, 1956, were £5,180,000. This figure is £1,320,000 lower than the corresponding one for 1955 and £1,650,000 lower than for the latter half of last year. Turnover increased, but profit margins were down, due to increased production costs and higher wages. The credit squeeze has affected the group's consumer goods sales. The value of output—at £61,200,000—for the six months was £2,600,000 higher than for the first half of 1955, but was down by £8,000,000 on the second half of 1955. Orders received totalled £66,900,000, which compares with £67,100,000 for the preceeding six months and £73,400,000 for the first half of 1955.

New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s.)

753,692. Bayerische Berg-Huethen-und Salzwerke A.G., 16 Ludwigstrasse, Munich, 34, Germany.

Iron and steel blasting materials such as those used for cleaning cast objects. It consists of round metal grains mixed with edged metal grains, preferably broken metal grains.

753,697. H. K. Williams, 30 Wellington Avenue, Beaumaris, nr. Melbourne, Victoria, Australia.

A method of producing a shell mould. A thin layer or veneer is built up on to a heated pattern. For the layer, a wet mixture of a refractory material of a relatively fine nature (finer than 200 mesh) and a bonding agent is used, so as to constitute the operative surface of the shell. Added to the veneer is a quantity of relatively coarse (20-80 mesh) refractory material and a bonding agent to constitute the body of the shell mould. The average thickness of the veneer is not more than 0.030 in., while the body of the mould has a thickness of between ⅛ to ½ in.

753,789. Enn Vallak, Grythyttan, Sweden.

A sinking-head box (see also Patent No. 731,324). The combustible or charable sinking-head box produced from porous material is provided, at least on each of its surfaces facing the interior of the chill mould and facing the metal being cast, and possibly also on its top surface, with a boundary layer of sand or powdered limestone with a suitable binder, of a nature such as to prevent the metal from absorbing any carbon from the combustible or charable material.

753,877. Sterling Aluminium Products, Inc., 2925 North Market, St. Louis, Missouri, USA.

Improvements in the casting of trunk pistons for use in internal-combustion automobile engines, whereby expansion of the piston ring may be controlled so as to maintain a close fit in the cylinder, whether the piston be hot or cold.

754,111 and **754,112.** Polygram Casting Company, Limited, Power Road, Gunnersbury, London, W.4.

Methods and apparatus for making moulds from a moulding mixture comprising a finely-divided material and a hardenable thermosetting resin, also in powdered form. (See also Patent No. 754,205.)

754,182. Texaco Development Corporation, 135 East 72nd Street, New York, 17, N.Y., USA.

A process for reducing iron-ore to high-purity iron with hydrogen.

Obituary

Mr. WALTER MEDCALF, who was managing director of the former Burnley Ironworks Company, Limited, has died at the age of 89. He was associated with the company for 57 years.

The death is recorded of Mr. H. SHILLITOE, the founder of British & Continental Traders, Limited, who conducted a considerable business in the export of pig-iron and rolls. Mr. Shillitoe was a linguist of high order and spoke Italian, German and French exceptionally fluently. He was a member of the Institute of British Foundrymen, having joined in 1912. For many years, he served on the London branch Council, where his services were highly appreciated. In his home town, Finchley, he did much public service, especially as a governor of the local hospital.

Book Review

Molybdenum (being No. 5 of a series, Metallurgy of the Rarer Metals) by Dr. L. Northcott, D.Sc. Published by Butterworths Scientific Publications, 88, Kingsway, London, W.C.2; price 41s. 3d. post free. An American edition of this book is published by Academic Press Inc., 125, East 23rd Street, New York, 10.

The founder of iron and bronze may consider that he has plenty of difficulties in melting and casting his alloys, but what would he think about having to deal with a metal with a melting point of 2,625 deg. C.? This is the value given for molybdenum, and conventional refractory containers are useless. Slip-casting methods can be employed for making molybdenum crucibles and powder techniques for preparing wire, rod and sheet. All these are dealt with in this book and a description is given of the vacuum/arc melting process introduced in 1943. Improved methods of arc melting are also detailed and an account is given of the production and properties of molybdenum-rich alloys.

The hot working of the cast material is naturally difficult, and extrusion proves to be a useful technique. An interesting chapter on joining methods describes the situation as being "rather fluid." Beyond establishing solubility limits, only a limited amount of work has been published on molybdenum alloys. The author has been associated with active research in these fields and not only writes with authority but is able to refer to many Government reports and unpublished work. It is the bringing together of the limited and scattered information on the physical metallurgy of molybdenum materials, having very useful high temperature properties, which constitutes the chief value of the present volume.

What might be called the tragedy of this refractory element is its extremely high rate of oxidation above 700 deg. C., and the melting of the molybdenum trioxide at 796 deg. C. At high temperatures the metal must therefore be used in non-oxidizing atmospheres or may be protected by surface coatings. A chapter of the book is devoted to oxidation and protection and it transpires that metallurgists are still very much in the development stage. Some information is given about "catastrophic oxidation" but the account does not run very smoothly and a description of the actual effect would have been justified. The oxidation of various alloys is reported and the behaviour of molybdenum/aluminium compounds is said to be most unusual. Incidentally on page 163 it is stated that these intermetallic compounds appear to be limited to two in number, but the account given of the tentative Mo/Al system on page 127 indicates a third.

The index refers to electrodeposited coatings, but the corresponding text deals only with the protection of molybdenum against oxidation by such coatings. Similarly if one turns up sprayed coatings, the text again deals with oxidation protection. It would have been valuable to have had references to the electrodeposition and metal spraying of molybdenum itself. For instance, in the building-up of steel parts by spraying it is understood that an intermediate layer of molybdenum gives greatly increased adhesion.

The book is excellently produced in the standard manner for this series, and those interested in the metallurgy of molybdenum and its physical and creep properties will be glad to have so much information sintered together. H. O'N.

ORDERS valued at over £4,000,000, well over half of which are for the export market, are announced by Leyland Motors Limited.

New Catalogues

Foundry Plant. From Badische Maschinenfabrik A.G., Durlach, Germany (British agents, W. J. Hooker, Limited, 239a, Finchley Road, N.W.2) has been received an English edition of their centenary catalogue. It runs to 220 pages, is well bound and attractively illustrated both in colour and black and white. The sole, yet minor, criticism the reviewer has to offer is that a few of the line drawings carry the designations in German. The book opens with an historical review of the company covering 100 years. No details are given of their own foundry, which is a sizeable concern making some 300 tons of iron castings a month. It is obviously used to try out their own productions of foundry plant.

The second section covers a wide range of moulding machines from the simplest to modern automatic plant. The third one is devoted to sand preparation and mechanized plants. The fettling shop next receives consideration and hydraulic, shot blast, *sand* blast, and tumbling barrels. The last section deals with cupolas, both cold- and hot-blast, baby Bessemers and sand drying plant and the like. The book is well indexed and ranks very high amongst foundry plant trade literature.

Unit Heaters. From the Standard and Pochin Brothers, Limited, Evington Valley Road, Leicester, Publication No. 1718 has been received which covers steam and hot-water units for factory heating. It takes the form of a 16-page well-illustrated brochure. The unit carries the trade name of "Calorier." Details are given as to installation and operation and performance. The brochure towards the end includes a number of useful tables. Copies are available to readers on application to Leicester.

Wet-type Dust Collectors. Several foundry applications are illustrated in a leaflet, No. 43, just issued by Dallow Lambert & Company, Limited, Thurmaston, Leicester. Steel, cast-iron and stelefoundry applications are depicted. Readers may avail themselves of the leaflet by writing to Thurmaston.

House Organs

In the Melting Pot. Issued by the Morgan Crucible Company, Limited, Battersea Church Road, London, S.W.11.

The June issue contains an article on a "Sample Method of Measuring Oil Consumption" which reads: "If a crucible furnace be equipped with an oil gate-valve as well as an oil regulating valve (all Morgan furnaces are so equipped) it is easy to obtain an estimate of the fuel consumption. When the furnace is running normally with the burner correctly adjusted, close the oil gate-valve (and the air valve) without touching the oil regulating valve.

"Remove the oil tube from the burner and turn the gate valve full on so that the oil runs into a container of known volume—a quart bottle for instance! Note the time in seconds required to run 1 quart of oil through the burner. Replace the oil tube and carry on melting. Since the oil regulating valve is not altered during this fuel consumption check, the oil flows through the burner into the container at the same rate as it does through the buner with the furnace running, and the fuel consumption per hour and hence per melt is easily calculated.

Fuel Efficiency Exhibition

The Fuel Efficiency Exhibition, which is currently being held at Olympia, will remain open to the public until October 10. Brief descriptions of some of the exhibits were published in last week's JOURNAL and a further series appears below:

AMONG the new exhibitors is Black Automatic Controls, Limited, Leafield, Corsham, Wilts, who are displaying on stand 16B, outer row gallery, National Hall, ranges of solenoid valves, pressure switches and thermostats. Pneumatic and hydraulic control equipment and indicator panel units will also be on view.

THE EXHIBITS of Shorrock Superchargers, Limited, Empress Works, Willenhall, South Staffs (stand No. 2, row A, ground floor) include a 200 seconds burner installed on a Beeston Robin Hood major boiler rated at 673,000 B.Th.Us per hour; a fully automatic gas-oil burner installed on a Perkins boiler rated at 155,000 B.Th.Us per hour; and another fully automatic gas-oil burner with output range of 100,000 to 445,000 B.Th.Us per hour.

SHELL-MEX AND B.P., LIMITED, are demonstrating the new control of low-temperature flue-gas corrosion process, developed by the British Petroleum Company, Limited, which is essentially the introduction of a metered quantity of gaseous ammonia into the flue gases. Under correct conditions, the ammonia combines with the sulphur trioxide and water vapour present to produce harmless ammonium sulphate. This corrosion-control system may soon be of benefit to those industrial fuel users who, in an effort to avoid low-temperature corrosion troubles, are having to operate boilers or furnaces below their attainable thermal efficiencies.

ON STAND D.6 of the Electrical Development Association, Metropolitan-Vickers, Limited and the General Electric Company, Limited, are demonstrating the advantages of using electric infra-red heating for stoving and enamelling. Another section of the stand is devoted to instrumentation and control, including an ultrasonic thickness gauge for determining the thickness of metal forming the walls of a vessel (Dawe Instruments) and an electrical process controller (Evershed & Vignoles). Thermodare and Nighstor thermal storage heaters are to be seen working under time-switch control, and another attraction is a working model of a typical factory section equipped with industrial lighting in which the illumination is automatically turned on or off by electronic light-sensitive apparatus. Finally, a small electrode boiler will be on view to show how steam for industrial process work can be speedily raised with boilers of this type.

ON STAND No. C.4 some of the member companies of the John Thompson group are exhibiting plant for industrial steam-raising and power generation. John Thompson Water Tube Boilers, Limited, are showing a Minipac package boiler which now has "unit-ised" fully-automatic control, the various controlling mechanisms being in five separate boxes mounted on the boiler frame and plugged in to a connection box. A feature of the boiler is the small floor-space required; the 5,000 lb. per hour unit operating on the stand requires only 55 sq. ft. It is manufactured in a range of sizes from 3,500 lb. per hour for working pressure up to 250 per sq. in. The Etaflo water tube boiler will also be shown by this company. A full-scale working set-up of the "Owl" vibratory conveyor and spiral vibratory elevator is being shown by Owl Engineering Supplies, Limited.

Personal

British Transport Commission announce that Mr. G. B. R. FEILDEN, engineering director of Ruston & Hornsby, Limited, Lincoln, has accepted their invitation to become a member of the Commission's Research Advisory Council.

Mr. J. W. WHIMPENNY has been appointed a joint managing director of W. H. Dorman & Company, Limited, with Mr. DARBY HADDON, who is chairman of the company. Mr. B. A. WILFORD, the commercial manager, becomes a special director.

Mr. W. C. MEYNELL, chairman of Meynell & Sons, Limited, brassfounders, of Wolverhampton, has completed 50 years' work for the company which was founded in 1798. The anniversary was recognized with a presentation to Mr. Meynell at the works.

At present commercial development officer of the British Iron and Steel Research Association, Dr. T. E. DANCY is vacating that position shortly to cross the Atlantic and join the technical services division of the Jones & Laughlin Steel Corporation in Pittsburgh.

Mr. J. S. ALLCARD, sales director of Easterbrook, Allcard & Company, Limited, Albert Works, Sheffield, has been elected chairman of the Sheffield branch of the National Union of Manufacturers. He succeeds Mr. John Ridgewell who has been elected president.

Four retiring workmen of Cockburns Limited, valve manufacturers, Glasgow, have each been presented with a wallet of notes. They are Charles Watkins, with 55 years' service; William Tinch, 45 years; Robert Brodie, 47 years, and Walter Sharp, 45 years' service.

Mr. S. B. DEW, of H. J. Maybrey & Company, Limited, of Sydenham, London, is to present a paper to the November meeting of the *Association Technique de Fonderie* on the "Control and Metallography in the Light-alloy Foundry as Related to Heat-treatment."

Mr. MARK H. PHILIPS, personnel director to the Heenan group of companies, has been appointed a director of the holding company, Heenan Group. Mr. C. M. A. WHITAKER, assistant general manager of Fielding & Platt, Limited, one of the associate companies of the group, has been appointed a director of that company.

Sir WILLIAM STANIER will be president of the Engineers' Guild during 1957. A former president of the Institution of Mechanical Engineers, Sir William began his career at the Swindon Works of the G.W. Railway. He became chief mechanical engineer of the L.M.S. Railway, and was seconded to the Ministry of Production from 1942-48 as Scientific Adviser to the Government. Since 1950, he has been chairman of Power Jets (Research & Development) Company, as well as a director of other companies.

At the annual general meeting of the British Internal Combustion Engine Research Association the Rt. Hon. the VISCOUNT FALMOUTH was re-elected president. Sir HAROLD ROXBEE COX, Dr. S. F. DOREY, chief engineer surveyor, Lloyd's Register of Shipping, Brigadier H. P. DRAYSON, director, Royal Engineer Equipment, Ministry of Supply, and Vice-Admiral Sir FRANK MASON, Engineer-in-Chief of the Fleet, were re-elected vice-presidents. Professor O. A. SAUNDERS, Professor of Mechanical Engineering, City and Guilds College, has accepted an invitation to become a vice-president. Mr. H. N. G. ALLEN and Mr. L. W. ROBSON were elected to the Council. Mr. G. W. BONE has been elected by the Council as their chairman.

News in Brief

THE SOCIETY OF INDUSTRIAL ENGINEERS and the Work Study Society are organizing a conference to be held at the Esplanade Hotel, Porthcawl, on October 26 and 27.

BIRLEC, LIMITED, Birmingham, has received a £300,000 order for three 40-ton arc furnaces for Brymbo Steel Works Limited, near Wrexham. They will replace existing open-hearth plant.

FORTH CHEMICALS, LIMITED, announce that the major expansion of their styrene monomer plant at Grangemouth, Scotland, has been completed and will come into operation this month.

A NEW ASSOCIATION—Management Consultants Association—with offices at 4, London Wall Buildings, London, E.C.2—has been formed by four of the leading firms of consultants in this field.

METALOCK (BRITAIN), LIMITED, the company which carries out cold repairs to metal castings, announce that their London workshops are now situated in Furze Street, off Devons Road, London, E.3.

Mr. PETER WICKINS has joined the staff of Safety Products, Limited, to look after the company's interests in the Midlands and the north of England; he will operate from his home at White Cottage, Great Longstone, near Bakewell, Derbyshire (telephone: Gt. Longstone 261).

A COUNCIL MEETING of the Australian (Victoria) branch of the Institute of British Foundrymen will be held at the Royal Melbourne Technical College on October 17. This will be followed by the presentation of a paper "Uses of Models in Pattern Production," by Mr. D. B. Wilson.

A CONTRACT, with a total value estimated at over $23,000,000, has been awarded to the Beryllium Corporation by the Atomic Energy Commission. Requiring the production of 500,000 pounds of nuclear-grade pure-beryllium metal, the new contract specifies delivery over a five-year period.

THE *Associazione Italiana di Metallurgia* (via Moscova 16, Milan) announce that the annual conference will be held—starting in Rome—on October 8, with post-conference trips to Naples, Civitavecchia and Sardinia. The return to Rome will vary according to the tour selected. It appears to be mainly touristic.

A REFRESHER COURSE for senior works and plant engineers, will be held at the University of Nottingham for a period of 20 weeks from October 23. Subjects include welding, corrosion prevention, wear and abrasion lubrication, the Clean Air Act, fatigue of metals, plastics, rubber, electronics and automatic control.

THE INAUGURAL MEETING of the newly formed Southampton Metallurgical Society will take place today at the Education Lecture Theatre of the Southampton University. After the election of officers, a paper, "Metallurgical Aspects of the Fatigue of Metals," will be presented by Mr. P. J. E. Forsyth and Mr. R. Stubbington.

MIDLAND SILICONES, LIMITED, have announced reductions in the home trade price of the main ranges of their MS 200 silicone fluids and their Releasil fluids and emulsions. The reductions, varying from 9d. to 1s. per lb., became effective from September 17. The new prices represent an overall reduction of more than 27 per cent. since 1952.

BECK & POLLITZER-CONTRACTS-LIMITED, Universal House, Southwark Bridge, London, S.E.1, have formed a new company, Beck & Pollitzer-Overseas-Limited, in order to provide a service catering especially for the needs of exhibitors abroad. Mr. Kenneth Priddy, who has been responsible for much of the overseas work, and who has been with the company for the last 16 years, has been appointed exhibition manager of this enterprise.

A PARTY of 39 undergraduates finished a week's course on iron and steel production, research and management in the Sheffield district on Saturday, September 22. They had been the guests of the United Steel Companies, Limited, and have visited Steel, Peech & Tozer Limited, Appleby-Frodingham, Samuel Fox & Company, Limited, and the Swinden laboratories at Rotherham. Officials of the Sheffield, Leeds and Liverpool Universities appointments boards accompanied the party as observers.

NEW PRODUCTION LAYOUTS, capable of producing 50 bogies a week, are nearly completed at the Grimesthorpe foundry of the English Steel Corporation, Sheffield. They will enable the firm to carry out the order for 2,300 steel bogies from the General Steel Castings Corporation of Granite City, Illinois, USA. The new layouts at Grimesthorpe are basically designed on ideas gained by members of the technical staff who have been visiting the American works over the past three years. The orders total £3,000,000.

SOHO HOUSE, Birmingham, where William Murdock, the 18th century pioneer of Soho Foundry fame, used to live, has been acquired by the General Electric Company, Limited, as a residential hostel for apprentices. Birmingham people and those others interested in the history of industry and its personalities hope that this may mean the preservation for posterity of this storied house. The city failed to retain Heathfield House, the Handsworth home of James Watt and another Murdock house at Sycamore Hill, both having been demolished many years ago.

NEWTON CHAMBERS & COMPANY, LIMITED, of Thorncliffe, near Sheffield, have designed and placed on the market a diesel-oil-fired domestic space-heater carrying the trade name Redfyre. Two models are available which give direct space heating, mainly by convection. Very high thermal efficiencies are claimed of 75 to 80 per cent. The heat evolved from the larger apparatus is said to approximate that of seven ordinary open fires. Besides these domestic models the company has also produced an industrial oil heater, suitable for small factories, workshops, garages, etc.

AT the ninth London Regional Display of the Engineering Industries Association, October 10 to 12, at the Royal Horticultural Society's New Hall, London, S.W.1, the Mond Nickel stand (No. 20) will this year be combined with that of their associates, Henry Wiggin & Company, Limited (No. 21), who are participating in the display for the first time. The display is devoted to welding, the main feature being a range of welded joints, illustrating the various methods of joining nickel-containing materials. A selection of technical publications issued by the two companies will also be available.

THE PRICE OF WATER for Sheffield industry, which has gone up from 1s. 5d. to 2s. per 1,000 gallons, costing industry an extra £139,000 a year, was described by Councillor L. S. E. Farris at the Sheffield City Council meeting on September 24 as exorbitant and unwise. The new charges come into operation on October 1, and 95 per cent. of domestic consumers will pay less and industrial consumers will pay more. Councillor I. Lewis said water had been so cheap for trade use that it had been wasted and Councillor C. R.

(Continued on page 400)

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* Durable
* Rigid
* Light

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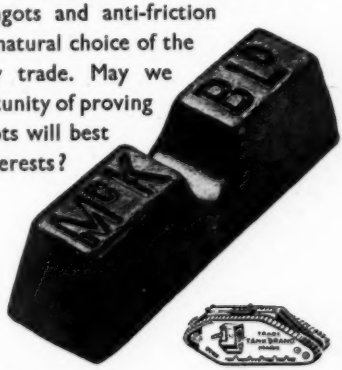

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News in Brief

(*Continued from page* 398)

Ironmonger, chairman of the Water Committee, said he had seen the greatest abuse of water in industry because of its cheapness.

IN its last monthly review of the motor trade, the Birmingham Chamber of Commerce *Journal* states that according to highly informed sources, the industry's difficulties are confidently expected to be followed by a revival but that revival is not expected for a year or more. Output this year might be reduced by something like 130,000 cars compared with 1955, but might still exceed that for 1954. The *Journal* describes the pattern of trade in the Birmingham district as "uneven and changing." It was a period of readjustment, redevelopment and a certain amount of rationalization intended to give more efficient production by cutting out overlapping and using individual factories for single purpose output.

LANCASHIRE DYNAMO GROUP OF COMPANIES announce the formation of a new company, Lancashire Dynamo Nevelin, Limited, which has been created to embrace the activities of the Nevelin Electric Company, Limited, and Lancashire Dynamo Switchgear, Limited. This step follows the decision of the Lancashire Dynamo group to purchase a new factory on a 30-acre site at Oxted in Surrey and to carry on there the production of Nevelin rectifiers, previously manufactured at Croydon, and Lancashire Dynamo switchgear, previously manufactured at Bridgwater. Mr. A. Newing, M.I.E.E., previously managing director of Nevelin Electric Company, Limited, has been appointed managing director of the new company with Mr. H. W. Bosworth, A.M.I.E.E., as chairman. The remaining members of the board are Colonel P. V. W. Gell, Mr. V. W. M. Press and Mr. W. R. Jones.

AT THE INVITATION of the British steel industry a delegation of 12 Soviet steel experts led by Mr. A. G. Sheremetiev, the Minister of Ferrous Metallurgy, arrived in the United Kingdom on Tuesday, September 25, for a fortnight's tour of British steel plants. An official dinner of welcome was given to the delegation by the British Iron and Steel Federation on behalf of the British steel industry. In the course of their visit the Soviet delegation will be received by the following companies: Samuel Fox & Company, Limited; Thomas Firth & John Brown Limited; Colvilles Limited; Dorman Long (Steel) Limited; John Summers & Sons, Limited; Stewarts and Lloyds, Limited; Steel Company of Wales and Richard Thomas & Baldwins, Limited. In addition the delegation will visit the BISRA laboratories (Sheffield), and the Steetley Magnesite Company.

MR. W. T. WREN, managing director of Allied Ironfounders, Limited, was the guest speaker at a meeting in Birmingham recently, of the Birmingham branch of the Incorporated Sales Managers' Association. He urged British manufacturers to concentrate on exporting their goods to Commonwealth countries, especially Canada and New Zealand. Not nearly enough had been done to develop the Canadian market, Mr. Wren said, and some goods sent to New Zealand had been below standard, a fact which buyers there were beginning to notice now that they had the opportunity to compare British products with those of foreign manufacturers. In the next ten years many people would try to break into our Commonwealth markets, Mr. Wren predicted, particularly Germany and Japan. More attention should be paid to the reports of sales executives when they returned home after a world tour he added.

Forthcoming Events

OCTOBER 6

Institute of British Foundrymen

Bristol and West of England branch:—"Some Interesting Foundry Techniques," by H. Balme, 3 p.m., at Glanville Street Public Secondary School, Plymouth.

OCTOBER 8

Institute of British Foundrymen

Sheffield and district branch:—"Its Members, with Special Reference to Apprentices as Associates," presidential address by J. F. Stanier, followed by dinner, at the Sheffield and Eccleshall Co-operative Society, Limited, Eccleshall Road, Sheffield, 11.

Institution of Works Managers

Tyne-Wear branch:—"Corrosion and Factory Maintenance," by Dr. T. A. Banfield, 7 p.m., at the Royal Station Hotel, Newcastle.

Institute of Metals

Scottish local section:—"Metallurgical Problems in the Heavy Organic Chemical Industry," by W. L. Wood, M.Sc., Ph.D., 6.30 p.m., at the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2.

OCTOBER 9

Institute of British Foundrymen

Slough section:—"Continuous Casting of Bronze," by Dr. E. C. Ellwood, 7.30 p.m., at the Lecture Theatre, High Duty Alloys, Limited.

Industrial Welfare Society

Discussion of Research Report (1): "Selection of Foremen," at Robert Hyde House, 48, Bryanston Square, London, W.1.

Institute of Meta s

South Wales local section:—"Inventions of Bessemer in Relation to Non-ferrous Metals," by Prof. H. O'Neill, D.Sc., 6.45 p.m., Department of Metallurgy, University College, Singleton Park, Swansea.

Incorporated Plant Engineers

Manchester branch:—"Industrial Drying," by R. R. Clegg, 7.15 p.m., at the Engineers' Club, Albert Square.

Institute of Industrial Supervisors

Dundee section:—"Supervisor and Time-study," 7.30 p.m., at the New Imperial Hotel, Fally Street.

OCTOBER 9 to 10

Birmingham and District Industrial Safety Training Centre

Industrial Truck Driver's Course. Details from the secretary, W. G. Appleyard, 21, Steelhouse Lane, Birmingham, 4.

OCTOBER 10

National Society of Master Patternmakers

Works visit to Westinghouse Brake & Signal Company, Limited, Chippenham, commencing 2.15 p.m.

Institute of Industrial Supervisors

Birmingham section:—"Implications of Automation," by F. G. Woollard, M.B.E., 7.30 p.m., at the College of Technology, Suffolk Street.

Wrexham section:—"Basic Principles of Work-study and its Purpose," by C. G. Chantril, 7.30 p.m., at the Denbighshire Technical College.

OCTOBER 11

Institute of British Foundrymen

Beds and Herts section:—Presidential address by Mr. A. F. Hammond, followed by films, 7.30 p.m., at W. H. Allen Sons & Company, Limited, Bedford.

Institute of Industrial Supervisors

Burnley section:—"Status of the Foreman," by S. Waugh, 7.30 p.m., at the Municipal College.

OCTOBER 12

Institute of British Foundrymen

National Works Visits Day in the Manchester area. The programme includes 10 works visits and dinner in the evening at the Midland Hotel, Manchester.

Tees-side branch:—"Foremanship," by F. Shepherd, J.P., 7 p.m., Teesdale Hall, Head, Wrightson & Company, Limited, Thornaby-on-Tees.

OCTOBER 13

Institute of British Foundrymen

Newcastle and district branch:—Visit to Wolsingham Steel Company, Limited, Bishop Auckland. (Details from the secretary.)

WHO USES FULBOND?

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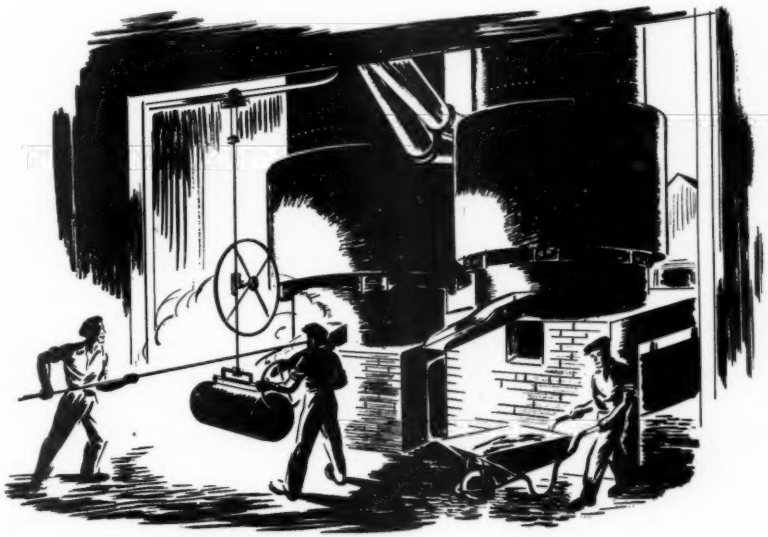

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CMF11

Raw Material Markets

Iron and Steel

Apart from the supply of basic iron for the steel-works, outputs of pig-iron are now ample to cover requirements; indeed, the position is easier than it has been for some time.

The heavy commitments of the steel industry and the desire to increase current outputs call for bigger supplies of pig-iron which will only be available when additional blast furnaces are blown in. The large furnace at Scunthorpe which was started again recently after repairs will be followed by other units now under repair or in course of construction. Pig-iron makers are well provided with iron ore and blast-furnace coke is ample for current needs.

With outputs of hematite and low-phosphorus irons at normal levels, and the reduced demand from some of the engineering foundries, supplies of these grades are more than sufficient for current foundry usage, and producers are able to fulfil commitments without difficulty; in fact, limited tonnages of low-phosphorus iron have been sent to customers abroad. The steel-works use appreciable tonnages of hematite, and makers are able to dispose of their outputs.

The light foundry trade is very slow in recovering, but it is hoped that the demands for cooking and heating apparatus and other domestic requirements will have a seasonal upsurge. More work is also needed by the textile-machinery makers and their demands for pig-iron remain on a subdued scale. Although the output of high-phosphorus iron, mainly used by these trades, is now at a low level, due to the fact that several furnaces have turned over to basic iron for the steel-makers, it is still sufficient to cover requirements. It is estimated that stocks at the furnaces and the foundries cover about four months' supply at the present absorption rate.

The re-rollers are in a satisfactory position in respect to steel semis, and they are getting better outputs because of some improvement in the labour position. Demand for heavy steel sections is maintained, but there is slackness in other departments. Galvanized sheets are easy, although some gauges of black sheet are in short supply.

Non-ferrous Metals

Copper is dull, although the undertone is steadier and a fair volume of metal is changing hands. Prices are holding up well, due largely to the absence of sellers rather than to the appearance of buyers. In the United States the copper market is also flat. Buying is largely for immediate requirements, and unless the demand improves the producers' price of 40 cents and the Customs smelters' quotation of 39 cents may have to be lowered. A pointer in this direction is the fall in the price of scrap to 31¼ to 31½ cents a pound. This is equivalent to 37 cents a lb. for refined metal for delivery three months hence. Since the US has relaxed controls on the export of copper and alloy scrap, it is quite possible that substantial supplies at this price can be made available, which cannot but have a weakening affect on the present price structure.

In Rhodesia, the Government Commission of Inquiry is now taking evidence bearing on the recent strikes. A spokesman for the mining companies is reported as having said that, unrest in the mining industry is in reality an essential and important part of an African nationalistic political movement. If allowed to proceed unchecked, it will disrupt the Rhodesian Federation's whole economy.

Lead remains brisk in America and quietly steady in London. Demand for zinc is modest in London and quieter in the States than in recent weeks. There is a possibility that US stockpile goals for domestically mined zinc—and lead—may be completed before the end of this year. This would soon be reflected in the zinc price unless demand from the automobile industry attains a high level and purchases of foreign ores against agricultural surpluses are maintained.

There is little to say about tin, which is a relatively steady market on both sides of the Atlantic. Supplies are still coming through the Suez on time and the labour situation in the East is easier. On the other hand, there is widespread unrest in Bolivia.

Official metal prices were as follow:—

COPPER, Standard—*Cash*: September 27, £292 to £292 10s.; September 28, £291 to £292; October 1, £292 to £292 10s.; October 2, £289 10s. to £290; October 3, £290 10s. to £291 10s.

Three Months: September 27, £291 to £292; September 28, £291 to £292; October 1, £291 to £291 10s.; October 2, £288 to £288 10s.; October 3, £289 10s. to £290.

TIN, Standard—*Cash*: September 27, £780 to £782 10s.; September 28, £782 to £784; October 1, £784 to £786; October 2, £773 to £775; October 3, £781 to £782.

Three Months: September 27, £767 10s. to £769; September 28, £768 to £770; October 1, £770 to £771; October 2, £759 to £761; October 3, £768 to £769.

LEAD—*Second half September*: September 27, £116 10s. to £116 15s.; September 28, £115 15s. to £116. *First half October*: October 1, £116 5s. to £116 10s.; October 2, £115 5s. to £115 15s.; October 3, £115 5s. to £115 10s.

Second half December: September 27, £114 5s. to £114 10s.; September 28, £113 15s. to £114. *First half January*: October 1, £114 to £114 10s.; October 2, £113 10s. to £113 15s.; October 3, £113 5s. to £113 10s.

ZINC—*Second half September*: September 27, £96 5s. to £96 10s.; September 28, £95 15s. to £96 5s. *First half October*: October 1, £95 10s. to £96; October 2, £95 to £95 5s.; October 3, £95 to £95 5s.

Second half December: September 27, £94 5s. to £94 10s.; September 28, £94 to £94 5s. *First half January*: October 1, £93 15s. to £94; October 2, £93 to £93 5s.; October 3, £93 5s. to £93 10s.

Revised Data Sheet

ALAR, Limited, 3, Albemarle Street, London, W.1, has just issued a new data sheet for Alar 21, now that the new alloy LM21 has been incorporated in B.S. 1490 "Aluminium Alloy Ingots and Castings for General Engineering Purposes." The data includes chemical composition; mechanical properties; strength at elevated temperatures; physical properties, machinability; corrosion resistance; anodizing; casting characteristics and heat-treatment. The new sheet is available to readers on writing to Albemarle Street.

Latest Foundry Statistics

The Council of Ironfoundry Associations has announced that the following number of ironfoundry workers were employed in the United Kingdom during the week ending July 28:—Males 132,865, and females 10,130, making a total of 142,995. Compared with June 30, the total has declined by 348 and with July 30, 1955, by 112.

BAKER PERKINS Shot Blast Equipment

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Engineers LTD
WESTWOOD WORKS – PETERBOROUGH

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

October 3, 1956

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £17 11s. 0d.; Birmingham, £17 3s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £20 8s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £20 12s. 3d.

Scotch Iron.—No. 3 foundry, £21 14s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £23 16s. 6d.; South Zone, £23 19s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £25 4s. 0d.; South Zone, £25 6s. 6d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent. :—N.-E. of England (local iron), £21 7s. 6d.; Scotland (Scotch iron), Zone S. 1, £21 14s. 0d.; Sheffield, £22 14s. 6d.; Birmingham, £23 2s. 0d.; Wales (Welsh iron), £21 7s. 6d.

Basic Pig-iron.—£18 3s. 0d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £48 0s. 0d. to £50 5s. 0d., scale 16s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £73 2s. 6d., scale 16s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 27s. 6d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 12s. 3d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £250 0s. 0d.; 38/40 per cent., £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 16s. 2d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 19s. 2d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent.C, £93 10s.0d. to £95 0s. 0d., basis 60 per cent. Cr, scale 29s. 9d. to 32s. 0d. per unit; over 6 per cent. C, £92 10s. 0d. to £93 0s. 0d., basis 60 per cent. Cr, scale 29s. 9d. to 32s. 0d. per unit; 2 per cent. C,* 2s. 1d. per lb. Cr; 1 per cent. C,* 2s. 1½d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £249 0s. 0d.; 96/98 per cent., £259 0s. 0d. to £265 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 22s. 6d. to 23s. 6d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £66 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £28 19s. 0d.; tested, 0.08 to 0.25 per cent. C, £29 19s. 0d.; hard (0.41 to 0.60 per cent. C), £31 0s. 6d.; silico-manganese, £39 10s. 0d.; free-cutting, £33 3s. 0d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £36 14s. 6d., silico-manganese, £39 17s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £34 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £35 16s. 0d.; acid, up to 0.25 per cent. C, £38 17s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £35 7s. 0d.; boiler plates (N.-E. Coast), £37 17s. 0d.; floor plates (N.-E. Coast), £36 16s. 0d.; sectional material, N.-E. Coast, £33 16s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested (4-ton lots), £36 3s. 0d.; flats, 5 in. wide and under (4-ton lots), £36 3s. 0d.; hoop and strip, £36 12s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g. £38 16s. 0d.; black sheets (hand mill), 17/20 g., £50 4s. 6d. galvanized corrugated sheets, 24 g., £62 2s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £61 13s. 9d.; nickel-chrome, £85 10s. 6d.; nickel-chrome-molybdenum, £96 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £290 10s. 0d. to £291 10s. 0d.; three months, £289 10s. 0d. to £290 0s. 0d.; settlement, £291 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 10¾d. per lb.; rods, 328s. 3d. per cwt. basis; 20 s.w.g., 361s. 6d. per cwt.

Tin.—Cash, £781 0s. 0d. to £782 0s. 0d.; three months, £768 0s. 0d. to £769 0s. 0d.; settlement, £782 0s. 0d.

Lead (Refined Pig).—First half October, £115 5s. 0d. to £115 10s. 0d.; first half January, £113 5s. 0d. to £113 10s. 0d.

Zinc.—First half October, £95 0s. 0d. to £95 5s. 0d.; first half January, £93 5s. 0d. to £93 10s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £127 10s. 0d.; rolled zinc (boiler plates), all English destinations, £125 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £110.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 4¾d. per lb.; rods, drawn, 3s. 2¾d.; sheets to 10 w.g., 312s. 3d. per cwt.; wire, 3s. 0¼d.; rolled metal, 297s. 3d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £199; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £253; HTB2 (38 tons), £266; HTB3 (48 tons), £265

Gunmetal.—BS RCH, —; BS1400, LG2 (85/5/5/5), £272; LG3 (86/7/5/2), £281; G1 (88/10/2/½), £335; (88/10/2/1), £327.

Phosphor Bronze.—BS1400, PB1 (AID released), £350 per ton.

Phosphor Bronze Strip, etc.—Strip, 432s. 9d. per cwt.; sheets to 10 w.g., 457s. 3d. per cwt.; wire, 4s. 5¾d. per lb.; rods, 3s. 9¾d.; tubes, 3s. 8d.; chill cast bars: solids 3s. 9¼d., cored 3s. 10¼d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 1d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 5¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 4¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 4d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £83 10s. 0d. Nickel, £519 0s. 0d. Aluminium ingots, £198 10s. 0d.; aluminium bronze (BS1400), AB1, —; AB2, £315. Solder, brazing, BS1945, type 8 (50/50), 3s. 1¼d. per lb., type 9 (54/46), 3s. 5d. per lb.

* Average 68–70 per cent.